Current Science

Vol. XVIII] JULY 1949 [No. 7

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FOOD SELF-SUFFICIENCY BY 1951

ONE of the colossal ventures on which the Government of India have embarked and one of the biggest challenges which they have accepted is, according to the Minister for Food and Agriculture, to deliver the country from the bondage of foreign food. The overall picture of the food deficit can be gathered from the data furnished by Government experts who have carefully examined the situation. Their findings record a 10 per cent. deficit of cereals, a 20 per cent. deficit of pulses, and a 150 per cent. deficit of fats. For meat, fish and eggs together, a three hundred per cent. deficit is recorded. The country suffers from a 200 per cent. deficit with respect to vegetables while with regard to fruits the deficit rises to 300 per cent. The deficit with regard to milk which is considered an essential nutrient, amounts to 350 per cent. When these deficits are made up, it is considered that the Nation would be in a position to feed itself adequately and in accordance with modern standards of nutrition.

Statements made in the press and from the platform may have given most of us the impression that the country is faced with a deficit of only ten per cent.; but this small deficit, we believe, refers only to that of cereals for whose supply we have been depending mostly upon dollar countries. The import of this important item of our diet has caused a severe drain on our dollar resources which, under normal conditions, should have been utilised for the building up of our industries. If only these imports could be stopped by making the country self sufficient with regard to cereals, the country can take up its programme of industrialisation. The stirring appeal made by our Prime Minister, Pandit Nehru, to the Nation in this connection should evoke an instant and spontaneous response from the heart of every citizen of India. He announced that the Government of India had decided to deal with the food problem on a war basis. "In the mighty drive for food production, which is ultimately a war against poverty and ignorance, against malnutrition and high prices," declared the Prime Minister, "every citizen can be a soldier and can

serve his or her country. All of us will have to tighten our belts."

Panditji outlined a three point programme for abolishing the 10 per cent. deficit :—

1. An intensive and better cultivation of the land, which should result in a 15 per cent. increase of yield ; 2. the growing of supplementary foodstuffs like sweet potatoes, tapioca and banana; and 3. bringing under cultivation lands in the compounds of the houses in towns and cities. We are all aware of the way in which England mobilised, during its fateful days of German blockade, its resources, every square inch of its land being exploited for food production.

The Central Government will extend all facilities and help to each and every participant in this great and patriotic endeavour and with a view to reduce the red tape and secure quick action and efficient co-ordination, some of the important suggestions of Lord Boyd Orr have been accepted. First, an administrative machinery which can function swiftly and efficiently without the normal delays of the Government apparatus will be set up. Secondly, perfect and smooth co-ordination and co-operation between the Centre and the Provinces and the States will be secured, and thirdly the organisers "must reach down to the farmer in the field". That is, there must be a closely knit series of links between the high level policy-makers and the farmers to whom belongs the ultimate responsibility of carrying out the policy. The farmer must understand and must willingly co-operate.

It would not be difficult to reach the target set by the Prime Minister by 1951 provided the Government machinery which has to organise this food drive is staffed with conscientious, efficient and competent personnel ; the people in general also have a compelling responsibility in this venture. During the World War II, England launched the "Dig for Victory" campaign which inspired the creation of Great Britain's land army who stepped up the production of food by 25 per cent. Let us "dig for self-sufficiency", and attain the target by 1951.

EDWARD JENNER, 1749-1823

1949 marks the Bicentenary of the birth of Edward Jenner—the Father of Vaccination.

Edward Jenner, born on May 17, 1749, at Berkeley, England, studied Pharmacy and Surgery and started his career as the House Pupil of the great Anatomist, John Hunter. In 1771, Jenner was assigned with the task of arranging Captain Cook's Natural History collections. He did this with such skill and success that Cook invited Jenner to join his next expedition. Jenner refused.

Jenner's epoch-making discovery of Vaccination came in 1796. It was the culmination of the careful experimentation and sound reasoning of Jenner who, to begin with, sought to verify the popular belief that cow-pox gave protection against Smallpox. It is an odd fact that the Royal Society rejected Jenner's findings although he was, by then, already a Fellow elected for his paper on "The Natural History of the Cuckoo". Undaunted by this rebuff, Jenner carried on his work and published his classical paper entitled *"An Inquiry into the causes and effects of the Variolæ Vaccinæ"*.

The importance and value of Jenner's work soon became evident and country after country adopted Vaccination as a preventive means against Smallpox. The first vaccination in India was done in Bombay in 1802. Jenner died in 1823 full of years and honours.

This in brief was the life and work of one of the great benefactors of humanity. And a grateful posterity will cherish Jenner's memory not merely for the protection he gave against a dreaded scourge, Smallpox, but for having kindled the trails of a new science-Immuno-therapy. Pasteur and Koch glowed the torch first lit by Jenner.

Like all truly great men, Jenner was unspoilt by his success and remained to the end what he always loved to be—a quiet country doctor, kindly and affable, fond of music, gentle but firm in his convictions, a lover of nature and above all, devoted to his work.

V. N. K.

THE INDIAN INSTITUTE OF SCIENCE AND THE EGERTON COMMITTEE REPORT

DEAR SIR,

Please permit me as an "Old Boy" of the Institute to offer you my sincere congratulations for your masterly review of the working of the Institute and suggestions for its improvement. Focussing public and Governmental attention on the Institute is not merely timely but national interest demands that nothing should be left undone to preserve the unique character of the institution as a centre of research and scientific activities. It has already contributed scientific personnel who hold positions of importance in Universities, Industries and Government organisations throughout India. In spite of many defects the Institute still occupies a prominent, if not the premier, position in the country as regards scientific activity. You have drawn attention to the lack of a well-defined policy as repeatedly pointed out by the four Reviewing Committees, and have commendably avoided controversial matters. One cannot help feeling that the Government of India must share part of the responsibility for the prevalent unsatisfactory state of affairs by taking away (I won't say 'enticing away') for example, the Director at a time when the Institute was at its lowest ebb in the matter of staff. It almost amounts to criminal negligence that the authorities have allowed several departments to run and students admitted without making adequate provision for teaching. A large number of professorial chairs are still without occupants, and this has been going on for several years. Is it too much to hope that the Governing Body and the Government of India at least now will take immediate steps to consolidate the existing departments before adding new ones?

The practice of *inviting* applications for the posts of Director and Professors seems to be *infra dig.* These should be *offered* to eminent men who should consider it an honour to serve the Institute. The terms of appointment should be sufficiently elastic and free from red tape. It is better that a few mistakes are committed rather than that good work is hampered by red tape. In this connection it is pertinent to recall the illuminating remarks made by His Excellency Sri. Rajagopalachari, the Governor-General of India, in the course of his Convocation Address to the Delhi University, which he delivered early this year (15-1-49). His Excellency declared:

"Where, in accordance with democratic ideas, we have adopted the procedure of election for filling positions requiring expert qualifications, to which appointments were made in the old days by authority, it is necessary to create an atmosphere which would attract the offer of such services by the most capable and high minded among us. We have seen how those who are best qualified to serve in civic administration stand aside, disliking the vexations attendant on election procedure and leaving third and fourth rate men to manage the affairs of local bodies as best as they can. The same fate should not be allowed to overtake our universities. I hope that these remarks of mine, which deal with a matter of very great and growing importance in many of our affairs, will be understood in the spirit in which I have uttered them."

As an "Old Boy" may I also suggest the filling up of a gap in the Institute? This is the provision of a Guest House for the use of vacation and short time workers. I have in mind the example of the Marine Biological Laboratory at Woods Hole. A number of people especially from the Universities would like to spend their vacations more profitably by taking advantage of the facilities which the Institute can easily provide. They could consult the library, attend short summer course lectures, or scientific discussions arranged by the different departments and even carry out some valuable work which cannot be done in their own institutions.

Yours faithfully,
M. R. NAYAR.

Lucknow University,
July 7, 1949.

THE THEORY OF THE CHRISTIANSEN EXPERIMENT

WHEN an isotropic solid, *e.g.*, glass, is powdered and placed inside a flat-sided cell which is then filled with a liquid with a refractive index equal to that of the powder for some wavelength λ_0 in the spectrum, beautiful chromatic effects are observed. This phenomenon is the well-kcown Christiansen effect and is made use of for making filters. The cell becomes transparent for a restricted region of the spectrum in the vicinity of λ_0, while the rest of the incident light appears as a halo surrounding the light source. The range of wavelengths regularly transmitted by the cell diminishes as its thickness is increased and is also influenced by other conditions of the experiment. Although many papers have been published both on the experimental and theoretical aspects of the Christiansen filter, there appears to be no recognition of the fact that the behaviour of such a filter should be determined by the principles of wave-optics. Sir C. V. Raman has considered the subject afresh and has shown that the effects exhibited by a Christiansen filter can only be explained in terms of wave-optics.

The basic concepts underlying the new approach to the problem are the following:— The powder—liquid mixture contained in a Christiansen cell is an optically heterogeneous medium, and its functioning depends on the fact that while this heterogeneity vanishes for λ_0 for which the two refractive indices (μ_1 of powder and μ_2 of liquid) are identical, it persists for adjoining wavelengths and disturbs the regular wave propagation in their cases. To find the effect of the cell on the passage of the incident light beam, the total thickness of the cell is conceived as divided up into a sufficiently large number of individual layers, each of which diverts part of the energy of the incident wave-train away from its original path in the form of diffracted waves. The wave-train finally emerging from the cell is that which had its intensity cut down in this manner by the cumulative effect of the successive layers through which it has passed. The diffracted radiations originating at the individual layers and emerging from the cell give rise to the halo observed in the experiment.

Approaching the problem from the point of view indicated above, Sir C. V. Raman has derived the following theoretical formula for the distribution of intensity in the spectrum of the transmitted light, the variables involved being the wavelength of the light λ, the average size of the particles of the powder Δ, the thickness of the cell z, and the difference in the refractive indices of the powder and the liquid for the wavelength under consideration $(\mu_1 - \mu_2)$

$$I = I_0 \, e^{-k^2\pi^2(\mu_1 - \mu_2)z \cdot \Delta^2/\lambda^2}$$

The characters of the halo observed around the light source are also discussed in terms of the diffraction theory. The Raman theory explains the facts of observation in a very simple manner and gives results in satisfactory accord with the available experimental data. However, the appearance of λ^2 in the above formula has yet to be demonstrated by fresh quantitative data.

R. S. K.

* Abstract of a paper presented by Sir C. V. Raman at the Scientific Meeting of the Indian Academy of Sciences held on the 30th June 1949 at the Indian Institute of Science. The full paper has appeared in the June 1949 issue of the *Proceedings of the Indian Academy of Sciences*.

DR. CHANDRASEKHAR

THE Russell Lecture, considered the most important astronomical lecture in the Americas, was delivered in Ottawa on June 21st by Dr. S. Chandrasekhar of Yerkes Observatory, Wisconsin. The lecture was one of the highlights of the 81st meeting of the American Astronomical Society, held in Ottawa, and invitation to deliver it is regarded as the highest honour this Society can bestow. Dr. Chandrasekhar is recognised as one of the world's leading authorities on mathematical physics. The subject of the lecture was "Turbulence—A Physical Theory of Astrophysical Interest".

CHEMOTHERAPY OF TUBERCULOSIS

C. V. DELIWALA, K. GANAPATHI AND S. RAJAGOPALAN

(Department of Chemotherapy, Haffkine Institute, Parel, Bombay)

Introduction

BEFORE the advent of modern chemotherapy, attempts have been made to cure tuberculosis with drugs without any success. The spectacular results obtained by Ehrlich with salvarsan aroused the optimism that this method could be extended to discover specifics for all infectious diseases. Thus, in the attempts to cure tuberculosis, innumerable compounds of diverse structures and groups, such as those derived from gold, silver, copper, mercury, cadmium and several other rare elements, calcium, arsenic, dyestuffs belonging to various groups, chaulmoogric acid and other related acid derivatives, etc., have been tried with disappointing results. The therapeutic effects obtained with even the best among them, *viz.*, the compounds of gold[1] do not stand comparison with those of Ehrlich. This lack of success with the bacterial infections as contrasted with the achievements with the protozoal infections such as trypanosomiasis and malaria, resulted in a sweeping rationalisation that chemotherapy cannot serve as a weapon for the conquest of the bacterial diseases.

However, the recent brilliant era in chemotherapy initiated by the discovery of prontosil, first dispelled the pessimism by providing spectacular cures against a number of deadly bacterial infections, the results obtained this time even eclipsing those of Ehrlich. The further developments in the subject from the practical and theoretical sides are now a common place. Researches on the wake of sulphanilamide forked out into two important directions. On the one hand, more and more powerful drugs were discovered, while on the other, the efficacy of these drugs in a large number of diseases was assessed. When it was recognised that the spectrum of antibacterial activity of the sulpha drugs was actually spreading out instead of the drugs remaining highly specific for just one infection, it was but natural to think of the sulpha drugs as suitable agents for destroying the tubercle bacilli and thus providing cures for tuberculosis.

Sulphanilamide and Derivatives

Attempts at the synthesis and trial of derivatives of sulphanilamide as possible cures for tuberculosis were started by 1938.[2] Rich and Follis[3] reported that sulphanilamide, administered in quantities almost bordering on the toxic dose, was able to arrest the progress of tuberculosis induced in guinea pigs if the treatment was started simultaneously with the infection. Buttle and Parish[4] found that sulphanilamide appeared to produce some degree of inhibition of an infection in guinea pigs with a human strain of tubercle bacillus ; but the drug had little effect on the course of infection in guinea pigs and none in rabbits when a bovine strain was used. Sulphathiazole was found by Ballon, Guernon and Simon[5] to exert bacteriostatic action on virulent human strains of tubercle bacilli on solid media and to arrest the development of experimental tuberculosis in guinea pigs. Following these reports, a number of investigators have tried many derivatives in experimental tuberculosis but the results are inconclusive ; some[6] have reported favourable effect if the drugs were administered in high doses, while others[7] could not confirm this. Zucker, Pinner and Heyman[8] tried sulphanilamide clinically on 13 patients giving the drug by the intravenous drip method maintaining a blood concentration of 17 to 32 mg. per cent. for 5 days at a time with no significant results. So far, no sulpha drug has established itself to be of any value in the management of tuberculosis.

Lipophilic Derivatives of Sulphanilamides

A number of fatty and other acid derivatives of sulpha drugs have been synthesised and tried on the basis of the heuristic hypothesis that the resistance of the tubercle bacilli to chemicals is possibly due to its protective fatty and waxy capsule and so any chemical with an inherent activity against the tubercle bacilli has a good chance in practice of killing the bacilli only if it could destroy or penetrate through the waxy capsule. This action on the waxy capsule is believed to be conferred on a compound possessing the fatty acid residue by virtue of its physical or " quasiphysical " properties.[9] Thus, Bergman, *et al.*[10] prepared lipophilic naphthalene derivatives by condensing 4-benzeneazo-1-naphthyl-

amine and 1-benzeneazo-2-naphthylamine respectively, with long chain acyl chlorides ; in preliminary trials, some of them were definitely, though slightly, effective in experimental tuberculosis in guinea pigs and in experimental leprosy in Syrian hamsters. Bergman and Haskelberg[11] extended this work and have prepared a series of N^4-acyl derivatives of sulphanilamide which have not been tested in experimental infections. Crossley, *et al.*[12] prepared a series of acyl derivatives of sulphanilamide ; of these, N^1-dodecanoylsulphanilamide was reported to be very effective in experimental tuberculosis in guinea pigs.[13] This claim has, however, not been confirmed by a number of other workers.[14] Rajagopalan[15] has synthesised a series of N^4-acyl and N^1 : N^4-diacyl derivatives of a number of sulphanilamides of established value in other bacterial infections. Wagner-Jauregg[16] prepared N^4-chaulmoogrylsulphanilamide and has reported this compound to have no curative action either in leprosy in rats or tuberculosis in guinea pigs. The isomeric N^1-chaulmoogrylsulphanilamide is reported to be equal to sulphanilamide in efficacy in experimental streptococcal infections.[17] Arnold[18] has synthesised many 2-sulphanilamidothiadiazoles with higher alkyl substituents in position 5 of the thiadiazoie ring ; these compounds are easily lipoid soluble but so far none appears to have been tried in tuberculosis or leprosy clinically.

Sulphone Derivatives

In the history of the chemotherapy of tuberculosis, it is only in 1940, that compounds (derivatives of 4-aminophenylsulphone) were found which were able to arrest definitely experimental tuberculosis in guinea pigs. Rist, Bloch and Hamon[19] found 4 : 4′-diaminodiphenylsulphone to be far more effective than sulphanilamide against avian tubercle bacilli infections in rabbits. In a detailed study with this compound in experimental tuberculosis in guinea pigs lasting 8 months, Feldman, Hinshaw and Moses[20] found that 71% of the untreated controls died of tuberculosis, while only 29% of the treated animals died, part of even this mortality being due to the toxic effects of the drug administered. The high degree of toxicity of this compound made its clinical use as such undesirable. However, it was found that the protecting of the amino group was a good method of masking the acute toxicity of the parent compound, at the same time making available a steady supply of the parent compound *in vivo* by hydrolysis. Of the many possible derivatives tried, three (promin, diasone and a phosphorylated compound) were found to be less toxic and of these the first two have been extensively tried in tuberculosis.

Promin (sodium 4 : 4′-diaminodiphenylsulphone-N : N′-didextrose sulphonate), though found to be far inferior to 4 : 4′-diaminodiphenylsulphone in its bacteriostatic action *in vitro*[20] for reasons explained above, has been found by Feldman, *et al.*[21] to modify the course of infection and favour healing of tuberculosis in guinea pigs (*cf.* also Steekon, *et al.*[22]). Promin has been tried clinically in pulmonary tuberculosis but it did not produce as good results as in the animal experiments. Diasone (sodium 4:4′-diaminodiphenylsulphone bisformaldehyde sulphoxylate) was found by Callowman[23] to be the most effective of the compounds tried in experimental tuberculosis in guinea pigs and also less toxic than the other sulphones. Feldman *et al.*[24] have confirmed these findings and produced more convincing evidence of the therapeutic value of diasone in experimental tuberculosis. As a result of this, a great deal was expected of diasone in the clinics. The controlled clinical trials with this drug have shown that this drug has not lived upto the expectations.

At this time, the heterocyclic derivative, promizole (4:2′-diaminophenyl-5′-thiazolylsulphone) was introduced as superior to diasone. Feldman, *et al.*[25] found this drug to be well tolerated and got very good results in experimental tuberculosis in guinea pigs. This drug was also tried by Feldman clinically. It is doubtful if it has been found to be better than the other sulphones. Just now, the interest in the sulphones was diverted to other channels.

Youmans and Doub[26] have tested the action of fifty-nine sulphone derivatives *in vitro* against virulent H 37 Rv strain of *M. tuberculosis*. These compounds comprise derivatives of 4-aminodiphenylsulphone and 4-aminophenylsulphone with a substituted heterocyclic ring. Only a few compounds came out showing activity comparable to 4 : 4′-diaminodiphenylsulphone. To check whether the *in vitro* method of testing is reliable as a short-

cut screening method to sieve out inactive compounds, Youmans, Feldman and Doub[27] have compared the effects of 33 compounds for activity *in vivo* and *in vitro*, the former tests being carried out in guinea pigs. The results have shown a fairly good correlation between the two methods so that we can take the *in vitro* tests as reliable for screening large number of compounds to have a qualitative idea of their activities.

Though the sulphones gave for the first time striking results in experimental tuberculosis in guinea pigs, the results obtained in the clinics are frankly disappointing. No significant advance was made in the practical side, though a fillip has been given to pursue the studies further.

Streptomycin and the Antibiotics

When the enthusiasm for the sulphones was dying down as a result of the clinical trials, streptomycin entered the scene with a great deal of partiality in its favour because of the spectacular performance of the other antibiotic, penicillin. Streptomycin gave such impressive results in experimental tuberculosis in guinea pigs[28] that it was hailed to be the long sought for specific for the conquest of tuberculosis. A number of reports on the action of streptomycin have been published, the most authoritative one being that of the Medical Research Council.[29] While no doubt streptomycin is probably the first drug to show very definite curative effect in tuberculosis, its use is limited. It has been found to be of value in acute and exudative cases of tuberculosis wherein the cavity has not developed, while it is of doubtful value in older cases. More extensive trials under controlled conditions will enable us to understand the merits and limitations of streptomycin therapy.

The puzzling feature about streptomycin, which greatly restricts its use, is the fact that *M. tuberculosis* exist (or develop ?) which are not only resistent to streptomycin but also requiring streptomycin.[30] Those cases harbouring the organisms sensitive to streptomycin give good results by treatment for about two months. Where the resistant organisms predominate as a result of killing of the sensitive ones, the treatment with streptomycin only worsens the case. Since the percentage of the organisms resistant to or requiring streptomycin is only a small fraction, by combining streptomycin with another drug which can tackle the resistent and the "requiring" organisms, we can hope to obtain very encouraging results. The value of streptomycin in tuberculosis can be appreciated only against the background of the previous consistently disappointing results obtained, in which state of hopelessness even the gold compounds were taken to be cures.

The example of streptomycin has led to the search for other antibiotics. So far none has entered the stage of clinical trials.

Para-Aminosalicylic Acid

When the mind is being prepared to accept as a dogma that the antibiotics are more likely to provide cures (and also give clues to synthetical investigations by suggesting possible structures), there is a swing back to the syntheticals by the discovery of the striking activity of such a simple compound as para-aminosalicylic acid. This compound was discovered by Lehman[31] as a result of testing 60 compounds *in vitro* as a possible antagonist of salicylic acid which stimulates the respiration of the tubercle bacilli. The original claims of Lehman have been confirmed[32] and this drug is being tried clinically. The past experience with clinical trials with compounds in tuberculosis urges a great deal of caution in giving out any pronouncement at this stage. But it is definite that the discovery of the therapeutic effect of this compound gives a very good lead to search systematically for possible cures even among compounds of simple structures.

Fallacies about the Results in Animal Experiments

A critical review of the literature of the chemotherapy of tuberculosis and particularly those published during the last ten years shows that the enthusiasm created by the animal experiments being damped by the actual clinical trials is a regular feature. There are many important reasons for this. In the first place, as far as the laboratory experiments are concerned, we did not have standardised techniques of animal experiments worked out yielding consistent results that could easily, without fallacy, be extrapolated to the human level. Secondly, the significance of the animal experiments as the index of their value in human tuberculosis in the various stages of the disease, was not fully appreciated and there was a hasty rush to report apparently favourable results. Lastly, the testing of the drugs clinically in such a chronic in-

fection—which presents diverse pathological pictures and the results being influenced by a number of factors ranging from psychological to nutritional is so time-consuming and tedious that it is difficult to realise and rectify the mistakes at an early date. This slows down the tempo of research also. Since it takes a long time to accumulate enough clinical data of significance to prove or disprove a claim, there is ample chance for any prejudice or favourite opinion to gain a strong foothold and misguide both the scientific workers and others. The case of the gold compounds is a good example for this.

In recent years, the methods of experimentation have improved. We are now convinced that a drug acts mainly on the parasite and it is axiomatic that the drug should act on the parasite *in vitro* if it is to be of value as a chemotherapeutic agent. Because of the slow rate of growth of the tubercle bacilli and that too in clumps, even the *in vitro* methods of testing of the activity of a compound as conducted previously did not yield reproducible results. The new methods now developed in which a new medium and the human strain can be used,[33] have vastly improved the position and is capable of yielding reproducible results in much shorter time. Thus, the initial screening method has speeded up the progress.

The animal experimentation technique using guinea pigs and the human strains of tubercle bacilli, is now well standardised. The method worked out by Dubos using white mice should indeed be a boon, if it is found to give reliable results. The results obtained with the sulphones in experimental tuberculosis is indeed suggestive of definite therapeutic action. But even in these cases, the results obtained correspondingly in the clinics are frankly disappointing. According to the principle of chemothearpy, the ideal conduct of the animal experiments should be such that animal infection should simulate the course of the disease in human beings as close as possible so that the results obtained in the former could be taken as an indication of what we can anticipate in the clinics. In many cases, particularly in the very acute infections such as those due to streptococci, pneumococci, meningococci, etc., the course of the infection in the infected animals (mice) and the human beings are not at all similar. Still, the results of the animal experiments and those obtained clinically remarkably correspond in these cases ; what appears to be of significance in deciding the clinical result is the fate of the parasite in its encounter with the drug in the system (of the animal or human beings). If a difference exists in the pathological picture of the experimental animal and the diseased human beings, or the drug undergoes different courses or degrees of absorption or metabolisation in the two, then we should expect concrete difference between the animal experiments and the clinical results. In the case of tuberculosis in the guinea pigs, wherein the course of the disease is not as chronic and the pathological picture also not as complicated as that of the human being, the drug, if it possesses an inherent action on the tubercle bacilli, will have a good chance to encounter the bacilli and destroy them. Thus the drugs that show protective action in the experimental tuberculosis in guinea pigs no doubt indicate an inherent good action of the drug and satisfied an important requirement. The failure in the case of human tuberculosis, particularly in advanced cases, is probably because the drug has not been given a chance to encounter the bacilli ; the devascularised character of the tubercular foci with the caseous area constituting the barrier zone between the circulating blood and the tubercle bacilli is responsible for this. So a drug to be useful clinically should also possess the property to approach and penetrate through the tubercle. Or else, the inherent tuberculostatic or tuberculocidal properties of the drug, however powerful it may be, will be of no use in actual practice. Such compounds can be used only in those cases wherein it could easily and directly be brought into contact with the bacilli, in such cases as tubercular meningitis, empyema, etc.

The pathological features of tuberculosis in human beings has thus presented chemotherapy with a very difficult problem. Since chemotherapy is concerned with the direct attack on the parasite, the only way it can solve the problem is by providing a drug which could eliminate completely from the system all the tubercle bacilli, whether free in the tissues or fortified within the devascularised foci, allowing the damaged areas freed from the parasite to recover with the aid of the body defence

forces. These conditions referring to the conduct of the drug in the system, extend the number of specifiations of a good drug in addition to the inherent action on the bacteria. Since the drugs in the case of tuberculosis have to be administered over an extended period of time, the question of chronic toxicity is also of vital concern.

Only when all the above have been taken into consideration, one can appreciate why the advance in the case of tuberculosis is not as rapid as in the other acute diseases. The results so far obtained have given us definite leads enabling a rational attack of the problem. While we cannot possibly eliminate the sanatorium or the surgical treatments, we can hope to effectively supplement these established methods.

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Note.—The cost of printing this contribution has been defrayed by a generous grant from the National Institute of Sciences, India,—*Ed.*

1851 EXHIBITION SCHOLARSHIP

THE Royal Commissioners for the Exhibition of 1851 (London) have appointed Mr. K. G. Ramanathan to the Science Research Scholarship offered to India this year. Mr. Ramanathan is at present Lecturer in the Physics Department of the Indian Institute of Science, Bangalore. Of the 10 Scholarships so far awarded to India by the Royal Commission, four have been secured by students of Sir C. V. Raman working in the Physics Department of the Indian Institute of Science. They are Prof. N. S. Nagendranath (1937), Prof. R. S. Krishnan (1938), Dr. G. N. Ramachandran (1946), and Mr. K. G. Ramanathan (1949).

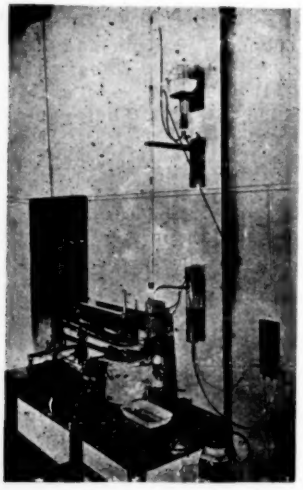
AN APPARATUS FOR THE CORONARY PERFUSION OF THE MAMMALIAN HEART

K. N. GOVINDAN NAYAR

(*Department of Physiology, Madras Veterinary College*)

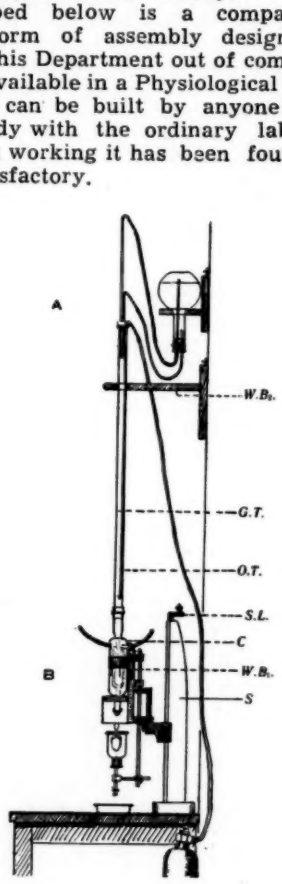
THE heart removed from the body and kept working is a fundamental experimental preparation used in the study of the role of various factors in the activity of the organ. The technique of doing this with the mammalian heart is not simple. The myocardium of the working heart must be well supplied with nutrient perfusing fluid, which should be well oxygenated and this should be made to circulate through the coronary vessels by maintaining sufficient hydrostatic pressure inside the aorta. The perfusate must also be at about the body temperature of the mammal.

To satisfy the above conditions as regards the oxygen supply, the temperature and the hydrostatic pressure, many forms of apparatus have been designed. The one designed by Gunn[1] is generally used. Harris[1] describes a simpler apparatus which can be constructed in the Laboratory. A very satisfactory one is the Vareed-Pillai apparatus. Messrs. Palmer & Co., Ltd., list in their catalogue another type of assembly.[2]



Basically the principles involved are simple, but in actual working the simpler types present many difficulties. Satisfactory assemblies using complicated components on the other hand are not easily available and are costly.

Described below is a comparatively simple form of assembly designed and built in this Department out of components usually available in a Physiological Laboratory. It can be built by anyone who is a bit handy with the ordinary laboratory tools. In working it has been found to be very satisfactory.



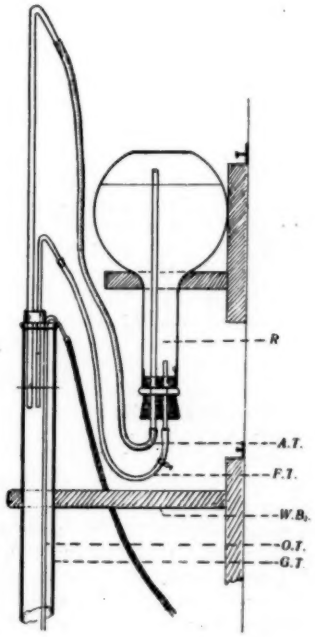
EXPLANATION OF FIG. 1

C., Condenser; *G. T.*, glass tube 40"×¾"; *O.T.*, Oxygen tube; *S.*, stand with the screw lift; *S.L.* screw lift; $W.B_1$, wooden board carrying the condenser; $W.B_2$, wooden board holding long glass tube.

The apparatus is assembled on a heavy stand with a screw lift, but can also be mounted on an ordinary stand screwed down to the table. The special screw stand however is very convenient in raising and

lowering the apparatus to take the tracing in any place on the smoked paper on the Kymograph. A wooden board 11″×3½″ is attached to the upright by two screws fixed to its back and clamped into two cross-blocks on the stand. On the board is fixed a good double surface condenser, 8″ × 2″ by a clamp and support. The outlet tube of the condenser is cut short and by its side is fixed a glass T-tube as shown, one of its limbs carrying a thermometer, another connected to the aortic canula and the third to the outlet of the condenser by a rubber tube carrying a pinchcock. The inlet of the condenser is connected to a long glass tube 40″ long and ¾″ internal diameter, by a one-holed rubber cork. This glass tube is held in position by being passed through a hole in a wooden board fixed to the wall at the proper height. The tube fits loosely into this hole.

The nutrient fluid is kept at a constant level in this tube by a simple arrangement the details of which are clearly shown in Fig. 2.



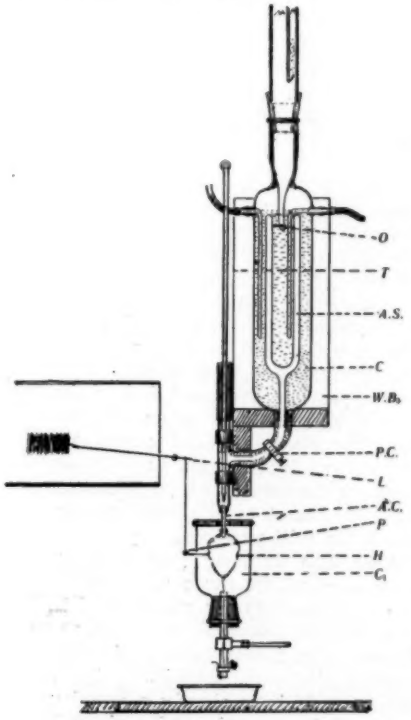
EXPLANATION OF FIG. 2

A.T. Air tube to reservoir ; *F.T.* Fluid tube from reservoir ; *G.T.*, glass tube 40″ × ¾″; *O.T.*, oxygen tube ; *R.* Reservoir (inverted 2 L. flask) ; $W.B_2$. wooden board.

A long thin tube ending in a fine curved nozzle reaches to the bottom of the column in the upright tube. A steady stream of small bubbles of oxygen is maintained and this ensures efficient oxygenation of the perfusate.

The temperature of the perfusate is controlled by circulating warm water through the jacket of the condenser. Cold water from the tap is warmed by passing through a copper jacket enclosing a 1000 W. immersion heater. The temperature can be easily controlled by adjusting the flow of water.

The heart after being attached to the canula is enclosed in a cover with a hole at its side, made from a bottle by removing its bottom. The arrangement of the lever, etc., follow the usual lines and the details are shown in Fig. 3.



EXPLANATION OF FIG. 3

A.C. Aortic canula ; *A.S.* Annular space of the condenser ; *C.* condenser ; C_1. cover for the heart ; *H.* The heart ; *L.* Lever ; *O.* Opening of the inlet of the condenser into the annular space ; *P.* Pulley (½″ vulcnite) ; *P.C.* Pinch-cock ; *T.* Thermometer ; $W.B_2$., Wooden board.

Mention may by made of the following features of this assembly.

1. Hydrostatic pressure in the aorta is kept constant irrespective of the level of the nutrient fluid in the reservoir.

2. The temperature remains steady and can be easily controlled.

3. The effects of various drugs, etc., on the heart can be studied by injecting them into the rubber tube connecting the outlet of the condenser to the T-tube through a thin hypodermic needle without disturbing the heart and introducing any irregularity in the tracing. For continuous perfusion with any solution other than the one in the reservoir, the reservoir can be quickly replaced by another containing the solution.

An assembly similar to the one described here has been in use in this Department for three years now and has been found to be convenient. This description is published at the instance of the Principal, Sri. S. V. Mudaliar, G.M.V.C., to whom the author is indebted for every encouragement.

1 "Experimental Physiology" D. T. Harris.
2. Catalogue of Messrs. Palmers Co. Ltd., London.

Note.—The cost of printing this article has been defrayed by a generous grant from the National Institute of Sciences, India.—*Ed.*

HONEY HUNTING*

SWARMS of bees pass overhead on any warm day in the Spring like a rapidly-moving smoke cloud that soon disappears into the distant forest. Swarms also form dense clusters two or three feet long on the branches of trees. Where they come from and where they go form a fascinating study.

Bees establish themselves in hollows of tree trunks and branches and continue to nest there for years. Each year when the nest or the hollow becomes too crowded and when there is not enough space for the bees to store a sufficient amount of honey to sustain the colony through the winter months, the bees provide a new queen for themselves by constructing large, more or less cylindrical, "royal cells". The grub that develops from the egg laid in such a cell is provided with "royal gelly", a special food secreted by the worker bees and fed to the bee that is to develop into a queen. When this new queen emerges, the old queen and part of the swarm leave their nest to seek a new home in the cavity of another tree, leaving the old home to the new queen and the brood she will produce.

Wild bee hunting has been a popular autumn sport in some parts of U.S.A. and gives the hunters the same thrill that fishermen derive. Several methods are used in locating the forest homes of wild bees but probably the most popular is the use of the bee-box. This is simply a wooden box approximately the size of a cigar box fitted with a glass top that slides in grooves. A hole about one inch in diameter is made in one end through which the bees can enter and leave. A slide is fashioned so that the hole may be closed if the hunter wishes to imprison the bees for a short time. An old piece of honeycomb about 4×6 inches completes the outfit. The bait to attract the bees is honey or sugar syrup, which is poured into the cells of the comb. On a warm autumn day when the frosts have stopped the honey flow, and the bees can easily be attracted to the bait, the box is set up on a stump or stand in a field near the woods. Now a piece of comb is burned or a few drops of oil of anise are poured on the stump to attract the bees. A few bees appear in a few minutes and take a drink from the comb, and fly back to their home in a "bee line". Next, the box is moved 200 or 300 yards to one side and another "bee-line" is obtained. The tree which is their home is located where the two lines cross. The home may be a tree, or a farmer's hive. Wild bees make their homes in the most unexpected places. A chimney or pipe of a gas-well derrick, the samson post of an oil well or an abandoned box-trap once used to catch rabbits, will house the bee nest.

Bee-hunters tap from 40-100 pounds of honey from the nests. The quality and type of wild honey vary considerably according to location, climate and the number of years the bees have occupied a tree cavity. The honey is usually strained from the combs, by placing them in a muslin bag and hanging it above the kitchen stove. The heat melts the wax capping of the cells and the honey drips through the bags. The bees wax is also preserved.

The cutting of bee-trees should be discouraged since bees are so essential to the fertilisation of our agricultural and forest, fruit and vegetable crops.

* Abstract of an article on "To Find Wild Honey", by Arthur C. Parsons. Grateful acknowledgements to *Natural History*, 1949, **58**, No. 4.

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SOME CONJECTURES IN NUMBER THEORY

The object of this note is to give some recent conjectures in the Theory of Numbers and what has been done about them.

1. *A Conjecture of Miller.*

If $\mu(n)$ and $M(n)$ be the well-known Möbius functions, then

$$A(n)=\left\{\sum_1^n M(m)\right\}\Big/ n \leqslant 0 \text{ for } n \geqslant 3.$$

The conjecture was verified by Miller for values of n up to 1000. I now find that the conjecture holds for values of n up to 20000 at least.

2. *A Conjecture of Chowla.*

If p be a prime of the form $4q+1$, then the sum of the quadratic residues of p which are less than $p/2$ is less than the sum of the non-residues less than $p/2$.

I have verified Chowla's conjecture for primes up to 200 and also for the primes 1009 and 1997.

Further, if p be a prime of the form $4q-1$ then I find that the sum of the quadratic residues of p which are less than p is less than the sum of the quadratic non-residues less than p, $p < 200$.

In fact, if $S(p)$ denote the sum of the quadratic residues specified above, then

$$S(p) \leqslant (p-1)^2/16 \text{ or } (p-1)^2/4,$$

according as p is of the form $4q+1$ or $4q-1$.

Govt. College,
Hoshiarpur, Hansraj Gupta.
May 18, 1949.

RELATIVE EFFECTS OF CARBON DIOXIDE, TEMPERATURE AND LIGHT INTENSITY UPON PHOTOSYNTHESIS

Researches in photosynthesis have shown that rate of carbon dioxide absorbed by leaves is related to concentration of this

gas in the atmosphere, temperature, and light intensity prevailing at the time of the experiment. To what extent these external conditions are related to photosynthesis is elucidated in this note.

Sugarcane leaves were gathered during the adolescent stage of the life-cycle. Their rate of photosynthesis was determined under wide ranges of external conditions by the continuous current method using baryta as an absorbent.

In a multi-factorial physiological process like this, the rate of photosynthesis (p) is dependent upon carbon dioxide concentration (c), light intensity (l) and temperature (t). The correlation coefficient (r) between (p) and one of these factors, *e.g.* (c) represents the relation between these variables. This is evaluated from the equation*:

$$r_{p.c.} = \frac{\Sigma\, dp.dc}{\sqrt{dp^2.dc^2}}$$

and S.E. $r = \frac{\sqrt{1-r^2}}{\sqrt{n-2}}$

where r = correlation coefficient;

$\Sigma\, dp.dc$ is the sum of products of deviation of p and c from respective means;

dp^2 and dc^2 = S.S. variance due to p and c;

n = number of samples;

and S.E. = Standard error.

Calculated in this way, the correlation coefficients between carbon dioxide, light and temperature, and photosynthesis are:–

$$r_{l.p.} = 0{\cdot}503 \pm 0{\cdot}18$$
$$r_{t.p.} = 0{\cdot}048 \pm 0{\cdot}21$$
$$r_{c.p.} = 0{\cdot}53 \pm 0{\cdot}18$$

Photosynthesis thus appears to be significantly correlated with both light and carbon dioxide, an increase in the latter two invariably raising the former. Temperature under the conditions of the experiment shows no significant relation at all.

Since the effect of one factor on photosynthesis is so interlinked with that of another, the correlation coefficients thus obtained may be partially or wholly affected by the simultaneous influence of other variables, the effect of which was not under experimentation. To eliminate this, net or partial correlation coefficients between each of the conditioning variables and assimilation rate of leaves are calculated as follows:

$$r_{lp.tc} = \frac{r_{lp} - r_{tp}.r_{cp}}{\sqrt{(1-r_{tp}^2)(1-r_{cp}^2)}}$$

$$r_{cp.lt} = \frac{r_{cp} - r_{lp}.r_{tp}}{\sqrt{(1-r_{lp}^2)(1-r_{tp}^2)}}$$

$$r_{tp.lc} = \frac{r_{tp} - r_{lp}.r_{cp}}{\sqrt{(1-r_{lp}^2)(1-r_{cp}^2)}}$$

Substituting the respective values of $r\,lp$, $r\,tp$, and $r\,cp$ in the above equations the net correlation coefficients are found to vary as follows:

$r_{lp.tc} = +\,0{\cdot}67$ (High positive correlation)
$r_{cp.lt} = +\,0{\cdot}59$ (High positive correlation)
$r_{tp.lc} = -\,0{\cdot}40$ (poor negative correlation)

Assuming that the relation between each of the factors and photosynthesis is linear at least under limiting concentrations of carbon dioxide as is usually found in the atmosphere, the next step lay in determining the straightline of best fit to represent the relation between the respective intensities of the factors and assimilation rate of leaves. This was felt all the more necessary in order to predict the rate of photosynthesis under varied conditions of external factors. Line of best fit is drawn by determining the constants a and b, and tracing the relation between p and c in the equation:

$$p = a + bc.$$

The values of the constants a and b are determined after the procedure laid down elsewhere.† These being known, the relationship between the three factors and photosynthesis is mathematically expressed by the equations:

$$p = 5{\cdot}36 + (-0{\cdot}079 \times t)$$
$$p = 2{\cdot}84 + (\ 1{\cdot}15 \times c)$$
$$p = 1{\cdot}26 + (\ 0{\cdot}0015 \times l)$$

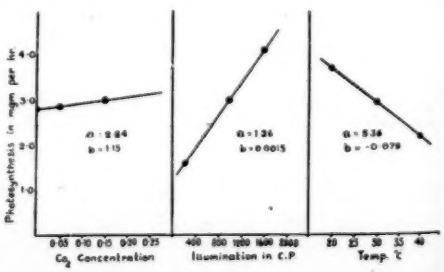


FIG. 1. Straight lines of best fit showing the relation between temperature, light intensity and CO_2 concentration and photosynthetic rate of sugarcane leaves

These equations may be referred to predict the expected intensity of photosynthesis under any specific concentration of the above three factors. The lowest value recorded would indicate this expected rate likely to be obtained under these conditions.

Another method is to draw out the line of best fit as shown in Fig. 1. The respective values of assimilation against the corresponding intensities of the three factors is read out; minimum rate of photosynthesis so obtained is taken to be the nearest approximation to the values that are likely to be obtained under actual experimentation.

From a close scrutiny of the calculated and observed values (Table II) it is obvious that the two approximate very closely under limiting concentrations of carbon dioxide whereas under higher percentages, differences are sufficiently high. For predicting the assimilation rate under atmospheric conditions of carbon dioxide, therefore, lines of best fit of the type drawn out in Fig. 1 are sufficiently helpful and may well be utilised for field investigations on photosynthesis.

TABLE I

Rate of photosynthesis of mature leaves of sugarcane per 100 sq. cm. per hour in mgm. of carbon dioxide under varied intensities of light, temperature and carbon dioxide

Expt. No.	Photo-synthesis	CO_2 %	Light C.P.	Temp. °C.
1	0·403	0·020	90	30·10
2	1·050	0·051	90	30·10
3	1·150	0·080	90	30·10
4	1·005	0·128	90	30·10
5	0·960	0·374	90	30·10
6	0·680	0·011	375	30·10
7	2·391	0·121	375	30·10
8	2·510	0·407	375	30·10
9	1·964	0·036	1500	30·10
10	1·480	0·011	1500	30·10
11	6·100	0·124	1500	30·05
12	6·38	0·403	1500	30·10
13	3·303	0·047	1875	30·10
14	6·290	0·124	1875	30·10
15	7·770	0·172	1875	30·10
16	7·920	0·358	1875	30·10
17	1·520	0·052	375	30·00
18	2·100	0·052	1500	30·00
19	2·230	0·051	1875	30·00
20	2·300	0·052	1875	23·00
21	2·82	0·052	1875	30·00
22	3·200	0·052	1875	34·00
23	3·050	0·052	1875	39·00

TABLE II

Observed and calculated rates of assimilation of sugarcane leaves under limiting and non-limiting concentrations of carbon dioxide in air

Experiment No.		Observed rate	Calculated rate
Limiting CO_2	3	1·15	1·39
	17	1·52	1·82
	18	2·10	2·99
	19	2·23	2·99
	20	2·30	2·99
	21	2·82	2·99
Non-limiting CO_2	12	6·38	2·98
	15	7·77	2·98
	16	7·92	2·98

From a close scrutiny of the calculated and observed values (Table II) it is obvious that the two approximate very closely under limiting concentrations of carbon dioxide whereas under higher percentages, differences are sufficiently high. For predicting the assimilation rate under atmospheric conditions of carbon dioxide, therefore, lines of best fit of the type drawn out in Fig. 1 are sufficiently helpful and may well be utilised for field investigations on photosynthesis.

Plant Physiol. Laboratory, College of Agriculture, Benares Hindu University, Banaras,
K. N. LAL.

February 23, 1949.

* Paterson, *Statistical Technique in Agricultural Research*, McGraw Hill, 1939. Pp. 106.

† Smith, *Agricultural Meteorology*, Macmillan, 1920.

ON THE POWER FUNCTION OF THE TEST FOR THE COMPATIBILITY OF AN ASSIGNED DISCRIMINANT FUNCTION

USES of Hotellings T^2-test may be classified into two broad categories, one, which is more familiar, represented by the test of significance of a fitted discriminant function, and the other by the test of compatibility of an assigned discriminant function. A more general problem, illustrated by Rao (1948), which may be grouped under the second category, is to test whether p assigned linear functions may reasonably be supposed to explain the differences between two $p + q$ variate samples. This classification is particularly relevant because, as the present author has shown, the power functions of the tests in the two cases differ. In other words the test criteria while following similar distributions under the null-hypothesis will have different non-null distributions. Following Rao's notation the test criterion for the class of problems under the latter category may be called the U-statistic, T^2 being reserved for the former category. The non-null T^2 distribution is already known (Hsu, 1938; Bose & Roy, 1938). The non-null U-distribution has been obtained by

the author as

$$\frac{1}{\Gamma\left(\frac{\nu-p-q+1}{2}\right)\Gamma\left(\frac{\nu-p+1}{2}\right)} e^{-\frac{1}{2}\delta^2} U^{\frac{q-2}{2}} (1+U)^{\frac{\nu-p+1}{2}}$$

$$\times \sum_{m=0}^{\infty}\sum_{l=0}^{\infty}\left[\frac{\Gamma\left(\frac{\nu-p+1}{2}+m\right)\Gamma\left(\frac{\nu+1}{2}+l\right)}{\Gamma\left(\frac{q}{2}+m\right)\Gamma\left(\frac{p}{2}+l\right)\Gamma(m+1)\Gamma(l+1)} (\tfrac{1}{2})^{m+l} (\delta^2)^l (\Delta^2-\delta^2)^m \left(\frac{U}{1+U}\right)^m\right] dU$$

$$\times I\left\{\frac{\Delta^2-\delta^2}{2}, \frac{\nu-p-1+2m}{2}, \frac{p-2+2l}{2}\right\}$$

where $I(k, a, b) \equiv \int_0^1 e^{-kx} x^a (1-x)^b \, dx$

In the above distribution δ^2 and Δ^2 are population parameters, the hypothesis under test being $\delta^2-\Delta^2=0$, and ν is the digress of freedom of the sample estimates of the population dispersion matrix.

Details are being published in the *Journal of the Ind. Soc. of Agr. Stat.*

R. D. NARAIN.

Indian Council of Agric. Research,
New Delhi,
March 15, 1949.

1. Hsu, P. L., "Notes on Hotelling's generalised T," *Ann. Math. Stat.*, 1938, **9**, 231. 2. Bose, R. C., and Roy, S. N., "Distribution of the studentised D^2-statistic," *Sankhya*, 1938, **4**, 19. 3. Rao, C. R., "Tests of significance in Multivariate analysis," *Biometrika*, 1948, **35**, 58.

NATURAL GAS AT JAWALAMUKHI MANDIR

THE history of the Baku oil-fields[1] in the Caucasus mountains is associated with the fire worshippers, who went there to visit the petroleum flames burning natural gas emitted from the earth. To them it must have appeared a very wonderful and awe-inspiring sight to see a fire fed with invisible fuel and burning from time immemorial.

Inside the famous temple, *Jawalamukhi Mandir*, in *Kangra District*, East Punjab, India, gas is constantly coming out of the soil and is being burnt. Through the year round people from distant places flock to this temple as a place of worship. As the gas does not appear to have been analysed so far, we considered an analysis desirable. Though the gas from inside the temple could not be collected, yet a sample of this gas was procured from *Tibi Gorakhnath*, distant a few feet from the temple. Gas was collected in an air-tight glass aspirator over gas-saturated ditch water. It was analysed in these laboratories using a modified Orsat's gas analysis apparatus. Its flame is very poor in luminosity. It showed practically no absorption over fuming sulphuric acid, bromine water and ammoniacal cuprous chloride solutions. The olefines, acetylenes and carbon monoxide, if present in the gas, may be present only in very small quantities. On exploding the residual gas with oxygen, the results of four different experiments showed it to contain a large amount of aliphatic hydrocarbons estimated as methane and a small portion of hydrogen. The composition of the gas corresponds almost to the natural gas coming out of the oil wells.

It is now well known that the Attock Oil Company[2] has been producing crude oil by drilling at Khaur, 45 miles south-west of Rawalpindi since 1914. Unsuccessful test-wells have been drilled in the Marwat Range, Trans-Indus, on the Sukkur dome, south of Rohri, in Sind and on the Mekran coast near Chandragup. It is most probable that oil occurs in the vicinity of Jawalamukhi Mandir either as a separate oil-field extending from Jammu to the Simla Hills or as an extension of the Indus oil belt.

India is very poor in her internal sources of petrol. Before the partition of the country, crude oil obtained from the oil-fields in Assam and the Punjab was utilized for the production of petrol. With the partition of the country by the creation of Pakistan, the Punjab oil-fields have passed on to the sister dominion and the Indian

Union is left only with the solitary source in Assam, which can meet nearly 10 per cent. of the country's petrol demand. For the rest of her consumption, India to-day has to import the supplies mainly from the neighbouring countries, namely Burma, Iran, Iraq, Bahrein Islands, etc. Recently the Government of India has invited foreign oil experts for consultations to set up oil refineries along the Indian coast and to manufacture synthetic petrol from the existing grades of Indian coals by the well-known Fischer-Tropsch method. It is, therefore, all the more necessary that large-scale oil prospecting in Kangra Valley need to be carried out by the Government of India and a number of oil wells be drilled after successful oil prospecting has been completed by the oil experts.

The authors take this opportunity of thanking Principal Narinjan Singh, Head of the Department of Chemistry, East Punjab University, for procuring us a sample of gas from the temple for analysis.

Physical Laboratory, MOHAN LAL KHANNA.
C.S.I.R., Delhi,
and Chemistry Dept., INDER SAIN GUPTA.
East Punjab Uni.,
Delhi,
May 20, 1949.

1. Evans, E. A., "Lubricating and Allied Oils," Chapman and Hall Ltd., London, third edition, 1945, p. 2. 2. Pinfold, E. S., "The Science of Petroleum," Oxford University Press, London, 1938, **1**, 138.

EMISSION SPECTRA OF THE MANGANESE HALIDES

IN a previous paper,[1] the author reported a system of bands of MnCl in emission in the region λ 3900-λ 3500. On the analogy of the interpretation of the MnF bands by Rochester and Olsson,[2] the above system was considered as due to a $^1\pi-^1\Sigma$ transition. But on account of the complex structure and abnormal intensity distribution among the heads, a transition $^7\pi-^7\Sigma$ (rather than $^7\pi-^7\pi$ as considered by Muller[3]) involving high multiplicity terms was suggested as perhaps more probable. While the analysis on this basis was in progress, Bacher[4] published a paper on the structure of the Mn halide bands, attributing them to the transition $^7\pi-^7\Sigma$. In MnCl, Bacher's analysis could be complete only for the $\Delta v=0$ sequence; the bands are obtained in absorption. The author has since confirmed the scheme and extended it to the remaining sequences $\Delta v=\pm1, \pm2, \pm3$, which he could obtain with a fairly good intensity in emission. A similar analysis of the MnBr bands corresponding to the higher sequence $\Delta v=+1$ is also obtained.

Details of the work have been communicated recently for publication in the *Indian Journal of Physics*.

Andhra University, P. TIRUVENGANNA RAO.
Waltair,
April 5, 1949.

1. Tiruvenganna Rao, *Curr. Sci.*, 1948, **17**, 209; —, *Ind. Jour. Phy.* (in press). 2. Rochester and Olsson, *Zeit. f. Physik.*, 1939, **114**, 495. 3. Muller, *Helv. Phy. Acta.*, 1943, **16**, 1. 4. Bacher, *Ibid.*, 1948, **21**, 379.

THE BAND SPECTRUM OF TiCl

IN the course of extensive investigations in our laboratory on the complex band spectra of diatomic molecules notably the halides of the transition group of elements, the band spectrum of TiCl is investigated. A characteristic spectrum is obtained by running a transformer discharge through TiCl vapour. Two systems are photographed in the regions—λ4209-3702, comprising in all of five groups. The first system was partially analysed by More and Parker. The two systems have a common ground state. The transitions may be $^4\pi-^4\Sigma$ and $^4\Sigma-^4\Sigma$ for the less and more refrangible systems respectively. The following are the approximate vibrational constants:

	ω_e'	$x_e'\omega_e'$	ω_e''	$x_e''\omega_e''$
System I	534	1·5	455	3·8
System II	474	4·4	455	3·8

Details of the analysis will be published shortly elsewhere.

V. RAMAKRISHNA RAO.
Department of Physics,
Andhra University,
May 28, 1949.

A STUDY OF THE SCATTERING OF LIGHT IN NORMAL URINES

IN a note[1] in the *Indian Journal of Physics*, S. Ranganathan reported results of depolarisation measurements of light scattered transversely in samples of normal

and pathological urines. Ranganathan's experiments were however confined to a measurement of depolarisation using incident unpolarised light alone. It was thought desirable to undertake a fuller investigation of the problem using incident light in the three states of vibration. With this object in view the present investigation was undertaken.

Upwards of some fifty samples of normal urines were subjected to investigation, the samples selected being such as to cover persons of both sexes and of different ages. The urines were obtained from the Madras Medical College, after being certified as normal.

The depolarisation factors ρ_u, ρ_v and ρ_h of the light scattered by the urine were measured using incident light, unpolarised, and polarised with the electric vector vertical and horizontal respectively. Sunlight was used as the source of illumination and the measurements were made visually by the Cornu method.[2]

The following results were obtained:—

(1) In all normal urines the value of ρ_u ranges from 7·5% to 13·0%. The upper limit compares favourably with Ranganathan's value but the lower one is slightly less than his.

(2) The unitary value of ρ_h in all normal urines points clearly to the conclusion that the scattering particles are small ellipsoidal particles, their size being small in relation to the wave-length of light.

(3) The values of ρ_v, which vary from 3·8% to 7·0%, are indicative of the optical anisotropy of the scattering particles.

(4) The factors of depolarisation seem to have no dependence whatever on the age or sex of the person concerned.

Further experiments with different types of pathological urines are in progress. Details will be published elsewhere.

In conclusion the author desires to express his grateful thanks to Dr. A. S. Mannadi Nayar, Surgeon-General with the Govt. of Madras, for his very valuable guidance in the conduct of the present investigation. The author's thanks are also due to Sri. D. V. Rao, Meteorological Officer, Willingdon, and Major Kumaravelu, Asst. Professor of Bio-Chemistry, Madras Medical College, for their helpful interest in the progress of this work.

V. P. NARAYANAN NAMBIYAR.
Physics Department,
Pachaiyappa's College, Madras,
June 14, 1949.

1. Ranganathan, S., *Ind. Journal of Physics*, 1931, **6**, 463. 2. Krishnan, R. S., *Proc. Ind. Acad. Sci., A*, 1935, **1**, 915-27.

ANGIOSPERMIC REMAINS FROM BARMER SANDSTONES

ON the 24th January 1948 Mr. S. K. Borcoah, Director, Department of Mines and Geology, Jodhpur State, sent the late Prof. B. Sahni a sample of 'Barmer Sandstone' containing a leaf impression. The specimen was kindly given to me by Professor Sahni for investigation. It was an incomplete impression of a dicot leaf (Fig. 1) not preserved well enough for identification. In order to search for more fossils from the locality from which the above specimen was collected I myself went to Jodhpur on 24th April 1948. There I met Mr. Borooah who very kindly accompanied me to the fossil locality.

The Barmer Hills are about a mile north west from the town of Barmer (25°40': 71°25'). Near the foot of the hills are situated five wells. Two of these had gone dry and were further excavated to strike water. It was from this recent excavation of one of these dry wells that Mr. Borooah had collected his sample. The well is at a distance of about 125 feet from the foot of the Barmer Hills and its present depth is approximately 110 feet. The lowermost bed of the well is of dark carbonaceous clay. Mr. Borooah and myself split about a hundred pieces of this clay and got four more impressions of dicot leaves, which too were incomplete. These leaves appear to belong to species different from the sample first sent by Mr. Borooah. We also collected a few impressions and incrustations of stems.

The microfossil examination of the matrix bearing the leaf impressions showed very interesting results. Small pieces of these rock specimens were macerated with Schulze's mixture (HNO_3+KClO_3). Their examination revealed a large number of angiospermic pollen grains (Figs. 2, 3 & 4) along with a few which appeared to be gymnospermous in nature. There are also present some spores of the tetrahedral type

and a good number of fungal spores most of which are septate. The fungal spores are of all the varieties from unicellular to multicellular. Many of the pollen grains have clearly preserved germ pores (as shown in Figs. 2, 3).

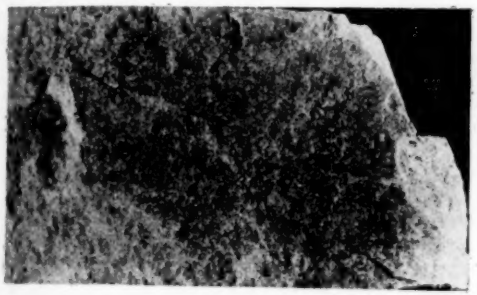


Fig-1 Nat. Size

Fig-2 × 720

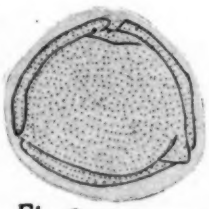


Fig-3 × 1040

Fig-4 × 720

FIG. 1. Impression of a dicot leaf.
FIGS. 2, 3 & 4 Angiospermic pollen grains.

There are two views regarding the age of the Barmer Sandstones. W. T. Blanford (*Rec. Geol. Survey Ind.*, Vol. X, 1876) correlated them with the marine Jurassic beds of Jaisalmer. T. D. La Touche ('Geology of Western Rajputana", *Mem. Geol. Surv. Ind.* Vol. XXXV, Pt. 1, 1902) thought that as the Barmer Sandstones contained dicot remains they could not be older than the Cretaceous. M. S. Krishnan in his book "Geology of India and Burma," 1943 pp. 252 and 374, mentions that these may be of the same age as the Himatnagar and Umia Sandstones. The age of these rocks is thus still a matter of controversy. The present discovery of definitely angiospermic fossils from the Barmer rocks is of considerable interest because, so far as I know, there is no published description or figures of the dicot remains mentioned by La Touche. Discussion of the age of the Barmer strata in the light of the fossils now found is reserved till the material has been worked out in detail.

Institute of Palæobotany, Lucknow, *May* 18, 1949. M. N. BOSE.

A PRELIMINARY NOTE ON THE PREPARATION OF ZIRCONIUM SUCCINATE JELLIES

ZIRCONIUM succinate has been described by Handl[1] as a white flocculent precipitate obtained on adding sodium succinate to a solution of a zirconium salt. An attempt has now been successfully made in this laboratory to prepare zirconium succinate jellies and this communication describes the preliminary results on the conditions under which they can be obtained.

The jellies have been obtained by the metathetical reactions between a 5% sodium succinate and a 15% zirconium nitrate solution. 2 c.c. of the zirconium nitrate solution are taken in test tubes and varying amounts of the sodium succinate solutions are added. The total volume is kept 6·5 c.c. The mixtures are thoroughly shaken and kept at 30° C. The influence of the varying amounts of sodium succinate on the time of setting of the jellies are recorded.

Amount of sodium succinate (c.c.)	Time of setting (Minutes)
3·9	120
3·7	160
3·5	200
3·3	230
3·1	260
2·9	280
2·7	300

When freshly prepared these jellies are perfectly transparent. They however gradually gain opalescence and finally become opaque when kept for a long time. They are perfectly stable, undergo no syneresis and are thixotropic in nature.

Further work on these jellies is in progress. Grateful thanks of the author are due to Dr. Satya Prakash for his kind interest in this work.

Chemical Laboratories, S. P. MUSHRAN.
The University, Allahabad,
April 30, 1949.

1. Handl, *Jahresbericht uber die Fortschritte der Chemie*, 1859, 279.

COLORIMETRIC DETECTION AND ESTIMATION OF THORIUM

A NUMBER of reagents have been reported for the detection of thorium,[1] but few are specific and interference from rare-earths is a common disadvantage. Germuth and Mitchel reported that sodium alizarinsulphonate (Alizarin-S) yields a red colour with the thorium ion which is neither sensitive nor specific. Details of the conditions in which the investigators arrived at these conclusions are not available. Nevertheless, it has been found that under the conditions detailed below, the reagent provides not only a fairly sensitive test, but may as well be used for the colorimetric estimation of moderate quantities of thorium. As the following data shows, the method may be applied for the rapid assay of monazite for thorium. The reagent is not specific for thorium only as zirconium, titanium, and tetravalent cerium interfere.

EXPERIMENTAL

(*a*) *Detection.*—The reagent is prepared by dissolving 0.01 gr. of alizarin-S in 100 c.c. of 0·125 N. hydrochloric acid and diluting the solution to one litre. One drop of the reagent gives with one drop of thorium solution, containing not less than 0·01 mg. of the element per c.c., a distinctive pink colouration. Cerite earths to the extent of 3 to 4 mg per c.c., cause no interference.

(*b*) *Estimation of thorium*: The following data obtained with a simple Dubosq colorimeter represent the average of a number of observations, which in the extreme did not differ by more than 5 per cent. It has been found that a standard made from 0·4 mg. of thorium and 10 c.c. of the reagent diluted to 20 c.c. gives the best results and thorium in amounts 0·2 to 0·5 mg. may be very conveniently estimated, although at the higher concentrations the results are a little low.

Thorium taken mg.	Cerite earths added mg.	Thorium found mg.	Thorium taken mg.	Cerite earths added mg.	Thorium found mg.
0·20	..	0·212	0·40	..	0·397
0·30	..	0·308	0·40	2·00	0·398
0·30	1·50	0·304	0·40	4·00	0·394
0·30	3·00	0·302	0·45	..	0·440
0·35	..	0·360	0·50	..	0·485
			0·50	2·50	0·484

(*c*) *Estimation of thorium in monazite.* A sample of monazite solution from which zirconium has been removed was treated with hydrogen peroxide to remove tetravalent cerium and after boiling to decompose the excess peroxide, the solution was to have a thorium content of 0·08 mg. per c.c. Aliquots of this solution were employed to determine the thorium content and the following results were obtained.

Amount of thorium present mg.	Amount of thorium estimated mg.
0·240	0·252
0·320	0·320
0·400	0·388
0·480	0·464

Chemical Labs., T. K. S. MURTHY.
Andhra University, BH. S. V. RAGHAVARAO.
Waltair,
March 19, 1949.

1. Moeller, Schweitzer and Starr, *Chem. Rev.*, 1948, **42**, 63. 2. Germuth and Mitchel, *Amer. Jour. Pharm.*, 1929, **101**, 46.

SEPARATION OF TETRAVALENT CERIUM FROM THORIUM AND OTHER TRIVALENT RARE EARTHS—THE USE OF POTASSIUM PERIODATE

A METHOD for the separation of tetravalent cerium from thorium and other rare earths including trivalent cerium has so far not been reported, although the separation of ceric cerium as $CeHIO_6$, H_2O on the addition of concentrated sodium paraperiodate has been reported by Ray Chaudary.[1] By carefully adjusting the acidity of the solution and the relative proportion of the H^+ and IO_4^- ion concentrations in solution, we

have succeeded in separating ceric cerium not only from thorium but also from other rare earths including cerous cerium.

Ceric Cerium: Ten c.c. of the ceric solution containing not more than 0·5 gm. of ceric oxide and other elements are mixed with 120c.c. of dilute (1 : 5) nitric acid and 70 c.c. of the periodate reagent in the cold (the periodate reagent is prepared by saturating 1 : 5 dilute nitric acid with the salt). The mixture is heated for 10 to 15 mins. on a vigorously boiling water-bath and left to settle. On cooling, it is filtered through a sintered glass crucible No. 4, and partially washed with 1 : 10 nitric acid. The precipitate is returned to the original beaker, dissolved in the minimum of concentrated nitric acid and diluted so that the acid concentration is approximately 2N., when the cerium periodate is reprecipitated. The precipitate is filtered and washed first with about 200c. c. of dilute nitric acid (1 : 10) and finally with 100 c.c. of cold water. It is then dried for three to four hours at 100 to 110°.C and weighed as $CeHIO_6$, H_2O.

Thorium: The filtrate is made distinctly alkaline with ammonia when thorium and other rare earths are precipitated as periodates. The precipitate is dissolved in dilute hydrochloric acid, potassium iodide is now added in sufficient quantity to decompose the periodate and the liberated iodine is boiled off. The oxalates of the elements are now precipitated after suitably adjusting the acidity, filtered, washed, and decomposed with nitric acid. The solution is neutralised until but faintly acidic to Congo Red, and the thorium is separated by any of the known methods (preferably adopting a double precipitation) ignited, and weighed as ThO_2.

Rare Earths: Oxalic acid is added in sufficient excess to the filtrate and the precipitated rare earths are washed, ignited, and weighed as R_2O_3.

In the absence of thorium however, the acid and the periodate ion concentrations may vary within wider limits.

In the following table are shown some typical results in which cerium, thorium and other rare earths are separated and individually estimated.

The importance of the strength of the acid during the analysis is shown by the following experiments. When nitric acid diluted in the ratio 1:4 is employed the amount of ceric periodate precipitated is only 0·4093 and 0·4119 gm. in two determinations and with nitric acid diulted in the ratio 1 : 6 the same is 0·4240 and 0·4251 gm. in the place of the correct amount 0·4184 gm. The precipitant in both cases was a saturated solution of potassium periodate in nitric acid of corresponding dilution.

Taken: CeO_2 0·1884 *gm.* + ThO_2 0·1906 *gm.* + *other rare earths including cerous cerium* R_2O_3 0·5700

Weight of $CeHIO_6$, H_2O found	Weight of CeO_2 calculated	Weight of ThO_2 found	Weight of R_2O_3 found
gm.	gm.	gm.	gm.
0·4178	0·1882	0·1902	0·5698
0·4180	0·1883	0·1904	0·5694
0·4184	0·1884	0·1903	0·5698
0·4179	0·1882	0·1902	0·5696

M. VENKATARAMANIAH.
BH. S. V. RAGHAVARAO.
Chemical Laboratories,
Andhra University,
Waltair,
April 30, 1949.

1. Ray Chaudary, *J. I. C. S.*, 1941, **18**, 335.

TICK-BORNE RELAPSING FEVER IN KASHMIR

THE existence of Relapsing fever in Kashmir was first detected early in 1948. Previously the disease had remained unrecognised due to its mild symptoms, no fatality, and resemblance with Malaria. Two species of Ornithodorus ticks, *O. crossi* and *O. lahorensis*, were found widespread in the State, particularly infesting the animal quarters. *O. crossi* were found infected in nature and the disease conveyed to guinea pigs by their bite was similar to that produced by human-strains from local cases. It attacked man far more readily than *O. lahorensis*, also the bite marks on patients resembled those of the former. On the other hand, naturally infected specimens of *O lahorensis* have not been found here so far, and lice could not be infected with the local strains. Therefore, it was considered that the vector of Relapsing fever in Kashmir was *O. crossi*. Detailed investigations will be published elsewhere.

K. N. A. RAO.
S. L. KALRA.
Field Typhus Research Detachment,
Armed Forces Medical College,
Poona,
April 29, 1949.

A NEW METHOD FOR THE ESTIMATION OF VITAMIN-C

VITAMIN-C is the only vitamin for which reliable and simple chemical methods are found. The one generally employed is Tillman's 2 : 6-dichlorophenol indophenol dye titration method. But this method suffers from the disadvantage of lack of precision in the end-point with old solutions of the dye, while with fresh solutions the experimental procedure becomes tedious. Several alternative methods also are to be found, and of these excepting the method of Roe & his collaborators[1–3] in which the red colour produced by dehydro-ascorbic acid with 2 : 4-dinitro-phenylhydrazine is measured, all are based on the reducing property of vitamin-C on several reagents, *e.g.*, methylene blue,[4] phopho-18-tungstic acid,[5] silicomolybdic acid[6] arsenotungstic—and arsenotungstomolybdic acids[7] and ferridipyrridyl sulphate.[8] We tried Folin's phosphomolybdic acid reagent (containing tungstic acid) for sugar and found that it gives blue colour with vitamin-C at room temperature only very slowly, taking many hours to reach the maximum. However, the colour develops rapidly at 100° C., but under these conditions fructose also produces the blue colour.

Next our choice fell on the phosphomolybdic acid reagent of Polis and Sortwell[9]. We found that this reagent gives even in the cold (30° C) an intense blue colour with such small concentrations of the vitamin as M/1000. The colour is found to be quite stable for several hours.

A number of substances (citrate, oxalate, malonate, malate, etc.) and sugars present in fruits were tested and none is found to give any colour in the cold. On heating to 100° C. few sugars gave colour, fructose yielding comparatively more colour. Cysteine and glutathione (GSH) gave no colour in the cold even with M/100 solutions. On keeping, however, a faint greenish blue colour began to develop slowly. These thiol compounds produced greenish blue colours in high concentrations, *e.g.* M/10, but the colours took several hours to reach the maximum intensities.

The method we have worked out, for the present for pure aqueous solutions of ascorbic acid, is as follows.

5 ml. of vit-C (M/1000 to M/100) in 10 per cent. acetic acid are treated with 0·2 ml. of the phosphomolybdic acid reagent and shaken well. A blue colour rapidly develops and reaches its maximum intensity in about 5 mins. The colour is found to be quite stable and proportional to the concentration of vit-C. The colour can be estimated colorimetrically, preferably on a photo-electric colorimeter. A further advantage of our method lies in the fact that the blue reduction compound can be estimated by titration against M/100 potassium permaganate from a micro-burette, till the blue colour disappears and there remains only an yellow colour due to the reagent. From the titre the vit-C content can be calculated.

Further work on the application of the method for foods and biological fluids is in progress.

B. NAGANNA. *
Dept. of Biochemistry,
Andhra Medical College,
Visakhapatnam, and
P. RAMACHANDRA RAO.
Dept. of Technology,
Andhra University,
Waltair,
April 28, 1949.

*Present address: Dept. of Chemistry, Madras Veterinary College, Vepery, Madras.

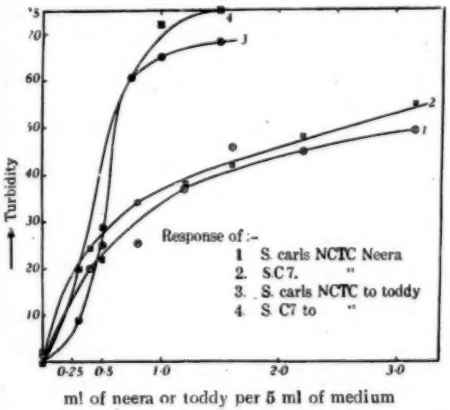
1. Roe and Hall, *Jour. biol. Chem.*, 1939, **128**, 329. 2. Roe and Kuether, *Ibid.*, 1943, **147**, 399. 3. — and Oesterling, *Ibid.*, 1944, **152**, 511. 4. Butler, *et al.*, *Ibid.*, 1943, **150**, 453. 5. Medes, *Biochem. J.*, 1935, **29**, 2251. 6. Isaacs, *Ind. Eng. Chem.*, Anal. Ed., 1942, **14**, 948. 7. Vonesh and Remezzano, *Chem. Abs.*, 1940, **34**, 7980. 8. Schulz and Floderer, *Ibid.*, 1940, **34**, 1698, 9. Polis and Sortwell, *Arch. Biochem.*, 1946, **11**, 229.

OVERALL GROWTH-PROMOTING POTENCY OF *NEERA* (UNFERMENTED JUICE) AND *TODDY* (FERMENTED BEER) FROM *PHOENIX SYLVESTRIS*

POWERFUL growth-promoting and therapeautic properties are popularly attributed to Neera or the sweet unfermented juice of the palmyra palm, *Phœnix sylvestris*. The problem of Neera—its preservation, nutritional value and its economic disposal—has, at the moment, attained great topical significance, and as part of a comprehensive scheme of investigation, the overall growth-promoting potency of the unfermented and fermented forms of Neera

has been determined by a microbiological method described earlier.[1]

Two cultures of yeasts, SC 9, NCTC 3006 and *S. carlsbergensis* NCTC 3056, whose vitamin requirements were previously determined, have been employed for all the assays and the results are graphically represented below:—



ml of neera or toddy per 5 ml of medium

The results show that fresh and unfermented neera possesses a low overall growth-promoting potency whereas the fermented counterpart exhibits a comparatively far higher potency. As could be gathered from the curves, the potency is doubled indicating a two-fold enrichment of the growth factors during the fermentation. This is not an unexpected result in view of the well-established fact that micro-organisms synthesise and secrete vitamins during their growth. This finding would point to the perhaps provocative conclusion that if the B-complex requirements are to be met from this source, fermented toddy should be prescribed even against the policy of prohibition—a conclusion which is in conformity with the observations of Professor J. B. S Haldane who, under the arresting caption of "Tragedy of Nauru," records that the infantile mortality among the Pacific islanders rose to 50 per cent. within six months of the enforcement of prohibition on the island. He adds "It was found that the children at the breast were dying of beri-beri, a disease due to the deficiency of thiamin. This substance is nearly absent from the rather monotonous diet of the mothers, but is present in large quantities in the yeast from which the toddy is made. The Medical Officer of Health discovered this fact and (doubtless after an appropriate delay) toddy was allowed again. The infant mortality fell to 7 per cent.

M. R. Raghavendra Rao.
M. Sreenivasaya.
Section of Fermentation Technology,
Indian Institute of Science,
Bangalore,
June 26, 1949.

1. M. R. Raghavendra Rao & M. Sreenivasaya, *J. Sci. Ind. Res.*, 1948, **7**, 116.

THE EFFECT OF COCOANUT WATER ON THE GROWTH OF IMMATURE EMBRYOS OF CORN (*MAIZE*)

Tukey (1933 and 1934) suggested that the very young sweet cherry embryos required for their growth certain heat stable factors found in yeast and fibrin digest in addition to sugar. Van Overbeek and his associates (1941) in their work on Datura embryo found that embryos that did not grow in Tukey's medium containing mineral elements, did grow when to this physiologically active substances were added. Cocoanut water in addition, was found to help better growth in very young embryos.

In an independent experiment designed to find out the period of viability for three-week old embryos excised from corn kernels that were cold stored (Uttaman, 1949) the effect of cocoanut water on the growth of the embroys was noted. The embroys that were daily dissected out of a number of kernels under aseptic conditions were placed in Tukey's general purpose medium and the effect of cocoanut water on their germination and growth daily watched. Water from mature nuts was cold preserved at freezing point and used as and when required. They were tried in two sets. To one was added cocoanut water daily at the rate of 3 drops for each embryo and to the other no cocoanut water was added. Growth measurements were made for 4 embryos under each set, each embryo being measured for two successive days beginning from the 3rd day of placing in the medium and finally on the 5th day. The results are recorded in the table below.

It will be noted from the table that cocoanut water has a decisive depressing effect

Embryo	No. of days	Without cocoanut water		With cocoanut water	
		Length of shoot mm.	Length of root mm.	Length of shoot mm.	Length of root mm.
No. 1	2	30·0	30·0	25·0	4·4
	3	34·0	38·0	31·0	4·5
	6	48·0	45·0	36·0	4·5
No. 2	2	16·0	21·0	5·0	0·1
	3	30·0	36·0	10·0	2·5
	6	47·0	48·0	22·0	2·5
No. 3	2	17·0	19·0	31·0	7·0
	3	38·0	46·0	38·0	7·0
	6	69·0	56·0	43·0	7·0
No. 4	2	27·0	22·0	25·9	5·5
	3	48·0	51·0	30·0	5·5
	6	66·0	60·0	36·0	5·5

on the growth of the embryo and that the effect on the root is more pronounced than on the shoot. Van Overbeek (1941) reported that in Datura the roots did not develop in the presence of cocoanut water but the shoot did. This finding then is not in absolute agreement with the above results in corn.

Agri. Res. Institute, P. UTTAMAN.
Coimbatore,
May 6, 1949.

1. Tukey, H. B., "Artificial culture of Sweet Cherry Embryos," *Jour. Heredity*, 1933, **24**, 7. 2. —, "Artificial culture methods for isolated embryos of deciduous fruits," *Proc. Amer. Soc. Hort. Sci.*, 1934, **32**, 313-22. 3. Van Overbeek, J., and others, "Factors in cocoanut milk essential for growth development of very young Datura embryos," *Sci.*, 1941, **94**, 350-51. 4. Uttaman, P., "A preliminary investigation into the viability of immature embryos of corn under conditions of cold storage at freezing point," *Curr. Sci.*, Feb. 1949.

PRELIMINARY NOTE ON THE HETEROECISM OF *PUCCINIA VERSICOLOR*

Heteropogon contortus (L.) Beauv. commonly known as spear grass, is widely distributed in Mysore and forms an important grass flora of dry pasture lands. *Puccinia versicolor* Diet. & Holway, a common leaf rust of the spear grass, has been collected in abundance from several localities in Mysore. The rust is so far known to be a hemi-form with subepidermal aparaphysate uredia and telia. The urediospores are hyaline and echinulate irregularly thickened in such a manner that the cavity has radiating projections giving a stellate effect. Cultural studies of this rust undertaken to study the mode of annual recurrence, indicated that the rust is heterœcious having *Plectronia parviflora* Bedd., a member of the Rubiaceæ, as alternate host. A preliminary account of the results obtained is presented here.

The uredial stage of the rust on spear grass first appears in the month of July-August, developing on yellow spots. The sori are yellowish-white in colour, erumpent and pulverulent. There is a rapid spread of the rust as a result of secondary infection incited by the urediospores.

The telia begin to develop in the month of January, first appearing as dark specks associated with yellowish-white uredia. They can be collected in abundance during the months of April and May at a time when the grass is withering due to dry conditions prevailing at the time. There are evidences to indicate that the rust does not oversummer in the uredial stage, as no viable urediospore could be collected around Bangalore in the months of April and May. The teliospores have been germinated in large numbers. The promycelium is external and four-celled bearing globular and hyaline sporidia which germinate *in situ*.

The possible occurrence of an alternate host bearing the æcial stage became evident after intensive field studies for several seasons. The uredial stage on the spear grass first appeared on clumps growing in the vicinity of *Plectronia parviflora* which is a common thorny shrub in dry waste lands. An unconnected *Aecidium* agreeing with *Aecidium Plectroniæ* Cke. has been collected near Bangalore for several years. The appearance of the æcial stage on *Plectronia* in the grasslands following the rains in June, was a strong indication that it was possibly connected with some grass rust.

Inoculation experiments were carried out under laboratory conditions. Teliospores from spear grass were germinated and the sporidia were used for inoculating young unfolding leaves of *Plectronia parviflora* grown under rust-free conditions. All the inoculations were successful, the inoculated leaves developing pycnia after eight days. The development of æcia soon followed.

Several controls that were set apart, all remained healthy. The infections on *Plectronia* were produced under laboratory conditions nearly two months in advance of their natural appearance in the field.

The æciospores produced by sporidial inoculation of *Plectronia parviflora* were used for reinoculating spear grass. Successful infections have been obtained the ūredia developing twelve to eighteen days after inoculation. A detailed account is being published separately.

Malleswaram, Bangalore, India, *June* 1, 1949. M. J. THIRUMALACHAR. M. J. NARASIMHAN.

INHERITANCE OF PETAL-BASE COLOUR IN LADY'S FINGER, *HIBISCUS ESCULENTUS* LINN.

WORK on the improvement of lady's finger crop in Bihar has been carried out from 1942 and as a result of these studies, a large number of true breeding cultures for various characters have been established. The present investigations deal with the inheritance of colour at the base of the petal, studied in the following two cultures.

Culture No. 9: The petal at the base is coloured pink on both sides. The culture was isolated from the material, collected locally.

Hawaii No. 1: The petal at the base is coloured pink on the inner side, whereas on the outer side it is yellow. The culture was isolated from the material, obtained from Hawaii.

Thus the parents differed in colour on the outer side of the petal base, *viz.*, in *No. 9* it is red and in *Hawaii No. 1*, yellow. It may be added that none of the cultures under observations showed complete absence of pink colouration on both sides of the petal-base.

The cross made during 1946 succeeded only with *No. 9* as female, after cross-pollinating four flowers, giving one well-developed fruit which produced fifteen seeds. The seeds germinated well and fifteen F_1 hybrids were thus raised.

All the F_1 hybrids developed pink colour on both sides of the petal-base. Thus the pink petal-base of *Culture No. 9* was dominant to the yellow petal-base of *Hawaii No. 1*, on the outer side.

Only eleven F_1 hybrids were carried forward in F_2. Germination was rather poor, as this generation was raised during the winter months which is not the normal season for this crop in these parts of the country. But those which germinated grew well and an F_2 population of 111 hybrids was raised, which were classified into 80 pink and 31 yellow, a close approximation to a 3 : 1 ratio, as shown in Table I.

TABLE I

Petal-base colour segregation in F_2 of a cross between culture No. 9 × No. 1

	No. of hybrids with pink petal-base	No. of hybrids with yellow petal-base	Total
Observed	80	31	111
Expected on 3 : 1 basis	83·25	27·75	111

In F_3, progenies of twelve F_2 hybrids, three with yellow petal-base and nine with pink petal-base, were studied. The former bred true for yellow petal-base and the latter behaved, as summarised in Table II.

TABLE II

Petal-base colour segregation in F_3 of a cross between Culture No. 9 × No. 1

	No. of segregating families	No. of pure breeding families (pink petal-base)	Total	No. of plants segregating in different families		
				Pink	Yellow	Total
Observed ..	5	4	9	35	15	50
Expected on monogenic inheritance basis	6	3	9	37·5	12·5	50

The F_3 population studied is small, but it satisfies the expectation, based on monogenic inheritance.

Thus the F_2 and F_3 data definitely show that pink petal-base differs from yellow petal-base (outer side) by a single factor, pink-base being dominant.

R. H. RICHHARIA.

Agricultural Research Institute, Botanical Section, Sabour, *April* 14, 1949.

MUTATION IN *BRASSICA CAMPESTRIS* LINN. VAR. *SARSON* PRAIN

IN one of the brown seeded varieties of *B. campestris*, an abnormal plant, having

FIG. 1

unusually curved and inflated pods (Fig. 1) appeared during the year 1945-46. An examination of the pods revealed that their inflated condition was due to the presence of one to two extra pods of smaller size which were completely telescoped into the outermost bigger pod (Fig. 2). The inner pods

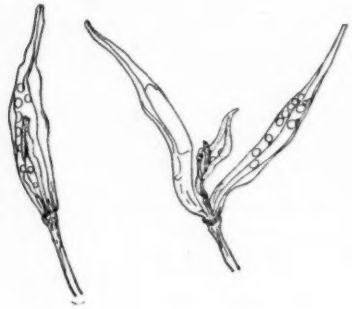


FIG. 2

looked normal and had the normal quota of ovules, though the ovules were much contorted and had smaller size than those of the outer pod. All the inner pods occurring in this plant yielded only two mature seeds, from which it appears that very few ovules in them were finally fertilized.

A cytological examination of this abnormal plant revealed the chromosome number to be $n=10$, which is the same as that of normal *B. campestris* plants. The bulk seeds produced in the following year normal and abnormal plants in the ratio of about 3 : 1. the actual number of plants being 42 and 16. The recessive plants resembled the mutant type very closely. These facts indicate that this is a case of a natural recessive gene mutation.

Anatomical structure of the pods, morphology of the chromosomes and further breeding behaviour are being studied to reveal its true nature.

G. N. PATHAK.
B. B. SINGH.

Govt. Agricultural College,
Kanpur,
January 3, 1949.

ON THE OCCURRENCE OF *CORDYCEPS SPHECOCEPHALA* (KL.) SACC. NEAR CALCUTTA

THE genus *Cordyceps* includes about 200 species,[7] and that they usually parasitise on insects, the bodies of which are transformed into sclerotia. The sclerotia usually preserve the shape of the insects and under favourable conditions give rise to stalk-like sterile stroma, with the perithecia at the distal end. The fruiting stage usually develops after the death of the host.

FIG. 1

In India only 2 species—*C. falcata* Berk. and *C. racemosa* Berk.—have so far been recorded on dead caterpillars from Khasi Hills[1], while Petch[6] described a number of species from Ceylon. It is now proposed to add another species to the very short list of Indian *Cordyceps*, and thus bringing the total upto 3.

The *Cordyceps* specimens referred to were found in Agarpara, near Calcutta (Fig. 1).

Cordyceps sphecocephala is perhaps endemic to the West Indies on wasps. About 190 years ago Father Torrubia noted this species from Cuba. It was supposed that such species as *C. sphecocephala* was a mutation of an animal into a plant[3].

Massee[5] recorded the distribution of the species from Jamaica, Cuba, St. Vincent and Brazil. According to Llyod[4] the species has also been recorded from Feldkirch in Austria, and that Quelet noted it from France.

Koltzsch first proposed the names of the species as above which was retained for sometime without change. But in the *Fungi of Cuba* Berkeley spelled the species as *C. sphecophila*, and under this erroneous spelling it is compiled in Saccardo[3]. But Massee[5] in his revision of the genus *Cordyceps* and very recently Kobyasi[2] in his monograph on the genus retained the original name.

The hyphæ within the host form a sclerotic fleshy deposit, often having cottony outgrowths, usually thinwalled, 3 μ—7·5 μ thick, granulated inside, sometimes branching, often with swollen tips, producing oval or conical or like cells, singly or in chains, measuring 11·5 μ-22·5 μ $\times$ 8 μ-12·5 μ.

The stroma usually arise from the upper part of the host, very rarely from abdomen, leathery-fleshy, 2-4 cm. long, consisting of a slender, sterile stipe and a fertile head ; stipe, simple, pale-yellow, fibrous, often 0·5-1 mm. thick; head elongated, usually clavate when mature, sometimes fusiform, upto 9 mm. long, 1-1·5 mm. thick.

The hyphæ composing the stipe are usually thin walled, transversely septate, 3·5 μ-7·5 μ thick, sometimes a few hyphæ produce somewhat swollen tips ; the hyphæ between the perithecia are crossed loosely and irregularly, 2 μ-3 μ thick. The pseudoparenchymatous wall is composed of usually several layers of oval rounded cells, 5·5 μ-12 μ across.

The perithecia are very prominent, completely and obliquely immersed, in the form of an ampule 300 μ—1000 μ long, 200 μ-300 μ broad, neck elongated ostiole not very clear. The asci upto 650 μ or more long, uniformly narrow, 6-7·5 μ broad, spores nearly as long as the asci, breaking into narrow fusiform segments 9μ—10μ long.

Host—*Pompilus* sp.

My sincere thanks are due to Professor S. R. Bose, Calcutta, for his invaluable suggestions and help in determining the species and making improvements in the MS., to Dr. F. J. Seaver, New York, for confirming the identification, to Dr. E. W. Mason, Kew, for sending me a transcription from Kobyasi's paper, to Mr. P. Sur and Mr. Baharuddin, Agarpara, for the material through the courtesy of Mr. A. K. Ghosh, Calcutta, and Mr. P. Mitra, Calcutta, for identifying the host.

Botanical Laboratory, J. SEN.
University College of Science,
Calcutta,
May 2, 1949.

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STRUCTURE AND FUNCTION OF BURSA COPULATRIX AND THE ASSOCIATED ORGANS IN BRUCHIDAE (=*LARIIDAE*) [COLEOPTERA—PHYTOPHAGA] AND THEIR TAXONOMIC SIGNIFICANCE

IN the female genitalia of Bruchidæ, the bursa in *Bruchus phaseoli* Gyll., & *Bruchus analis* F., are elongated and somewhat saccular although in the latter case, it is considerably larger in size. The bursa in *Bruchus chinensis* L., *Bruchus affinis* Frol. and *Spermophagus convolvuli* Thunb., is somewhat smaller than the other two species mentioned above, the relative shape being variable among themselves. The wall of bursa in *B. phaseoli* and *B. analis* bear internally near about the middle a pair of prominent round cup-shaped structures. In the case of the latter species, however, it was found on dissection to be well developed lobular rather hollow structures attached to the wall, of the bursa and somewhat pale yellowish in colour (Fig. 3*b*), whereas in the case of *B. phaseoli*, they are smaller, transparent somewhat fixed organs. So far as available literatures are concerned, nothing definite is known about these peculiar structures or their

functions nor any homology is existing in other families. Although Zacher[3] is of opinion that these organs function as accessory glands and secrete fluid for cementing the eggs, he concludes as follows which I quote: "Die Bideutung ist nicht clar, da mir Analogen bei anderen Familien nicht Bekannt sind". In my opinion as cement secreting accessory glands for fixing the eggs are separate system of organs traceable in other insects, they cannot possibly be lodged inside the bursa which has by itself a different function altogether. Mukerji and Bhuya[1] mention that these structures function as valves occluding the proximal vaginal part from the distal portion of the bursa and thus preventing, during copulation, further penetration distad by the everted endophallic sac,* Moreover, the crenulated rim of these cup-shaped structures their hollowness (Fig. 3*b*) together with their natural position in the bursa do not seem to support this theory. They can, however, only be partially occlusive in function.

is comparatively smaller and the spermatheca fairly developed, these paired structures although less prominent than in the case of *B. analis*, function similarly.

It is therefore likely that each of these cup-shaped structures with opening on one side in the form of an arc, act as pouches for temporary storage of sperms ejected in the bursa just after copulation and subsequently releasing them slowly on a fold (Fig. 3 *f*) of the bursa to be collected slowly by the opening of the spermathecal duct (Fig. 3 *Sd.*).

In *B. analis* near about the level of the cup-shaped structures, there lies internally and mesially a longitudinal somewhat thickly chitinized plate which bears internally a series of curved spines. Its probable function appears to be to check the penetration of the endophallic sac or the internal sac of Sharp and Muir[2] beyond the cup-shaped structures. So far, this chitinized plate on the bursa has been traceable only in *B. analis* and is thus a specific character.

FIG. 1

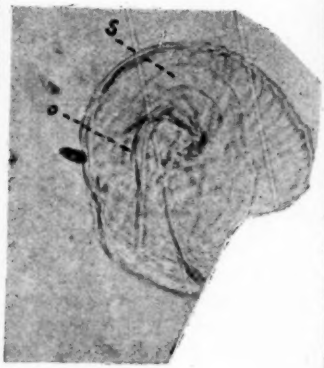

FIG. 2

FIG. 3

The shape structure and position of these organs in the bursa, in the absence of any other feasible explanation, gave evidence to the fact that they probably act as primary reserviors of sperms as in the case of *B. analis* where the bursa is comparatively larger and their spermatheca comparatively smaller in size. In the other species, *e.g., B. phaseoli* where the condition is reverse, *i.e.*, the bursa

The spermatheca (Fig. 1) in Bruchidæ is a double chambered organ consisting of an inner chamber (*i.c.*) and an outer chamber (*o.c.*), the former being inserted into the latter. Into the inner chamber opens laterad, the duct of the accessory gland (*ad*) which pours its contents direct into it. The wall of the spermatheca forms the outerwall of the outer chamber while its innerwall is limited by

the wall of the inner chamber (Figs. 1 & 2, *s*), leaving a definite lumen between them. Distally, the inner chamber is connected with the lumen of the outer chamber by an opening (Figs. 1 & 2, *o*). Basally, the spermathecal duct appears to consist of a double tube one inserted into another, the inner one being connected with the inner chamber while the outer one is continuous with the wall of the spermatheca at the base forming further distad the spermathecal duct. Functionally, when the muscles of the spermatheca contract and immediately relax, a partial vacuum is created inside the spermatheca and the released sperms rush through the outer ring at the base of the spermatheca (the inner ring remaining closed) and reach the lumen of the outer chamber. From the outer chamber they reach the inner chamber through the opening at (*o*). These sperms thus get mixed up with the secretions of the accessory gland and undergo necessary physiological changes in the inner chamber. Subsequently, when the wall of the spermatheca again contract the basal outer ring closes on the inner ring and the mature sperms are expelled from the inner chamber through the opening of the inner tube at the base of the spermatheca into the spermathecal duct thereby reaching the vaginal portion of the bursa. Thus, the outer and inner tubes at the base of the spermatheca appear to act in the Bruchids respectively as afferent and efferent ducts for the ingress and egress of sperms.

Division of Entomology, S. MUKERJI.
Indian Agri. Res. Institute,
New Delhi,
April 22, 1949.

*The presence of Cup-shaped structures at the distal ends of the bursa in *Bruchus minutissimus* Motsch., *B. pisorum L.*, & *B. affinis* Frol., goes against such a hypothesis.

1. Mukherji, D., and Bhuya, A. H., *Jour. Morph.*, Philadelphia, 1937, **61**, 175-214. 2. Sharp, D., and Muir, F., *Trans. Ent. Soc.*, London, Part III, 1912-13. 3. Zacher, F., *Arb. Biol. Reichsanst.*, 1930, **18**, 254-93.

ON SPAWNING CONDITIONS AND LARVICIDAL PROPENSITIES OF *CARASSIUS AURATUS**

IN Japan gold fishes are naturally distributed even in the smallest streams and are used as food.[1] They have got themselves naturalised in North American waters where they are known to grow to a size of two feet[2,3]; whereas in India they thrive only in garden pools and cisterns where they are cultured as ornamental fishes. They attain a maximum size of eight inches in length.

Although Khan[4] has studied the spawning of this fish from the Punjab, the conditions under which it breeds have not been ascertained. An attempt was made by us to study the conditions under which the fish thrives and breeds in three different places with varying meteorological conditions in South India; and the results are briefly stated below:

Physico-chemical conditions	Madras	Mangalore	Anantharajupettah
Date	14-12-1948	27-11-1948	5-2-1949
Turbidity in cm.	>30·0	>30·0	>30·0
Temperature in °C.	24·4	29·3	27·8
pH value	7·2	7·0	8·35
Dissolved O_2 (mg./litre)	4·6	5·2	3·5
Free CO_2 (p.p. 100,000)	0·954	0·347	nil
Bicarbonates (p.p. 100,000)	18·610	5·185	49·833
Chlorides as chlorine (p.p. 100,000)	10·4	4·2	14·0
Silicates as SiO_2 (p.p. 100,000)	1·4	present	2·301
Phosphates as P (p.p. 100,000)	0·004	present	0·1083
Nitrates as N (p.p. 100,000)	nil	nil	nil

The fish spawns throughout the year with maxima from May to August and from November to January. In Mangalore, South Kanara District (lat. 12° 52′ N. and long. 74° 50′ E.), where the climate is humid with an average rainfall of 130 inches per year and the atmospheric temperature ranges from 68 to 98°F., the fish has been observed to breed prolificly in garden ponds. It was found to spawn in cement cisterns in Anantharajupettah, Cudappah District (lat. 14° 20′ N. and long. 79° 5′ E.) which is one of the most arid parts of the Madras Province situated in the interior. The annual rainfall varies from 20 to 30 inches. The temperature rises to 100°F. in summer and falls to 55° F. in winter. In Madras (lat. 12° 5′ N. and long. 80° 20′ F.) where the mean temperature is between 75 and 88° F., the fish has been observed to breed in aquarium jars containing the City Corporation tap water. In all these places

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the fish attains maturity in one year when it is about three inches in length.

The physico-chemical conditions of the above three places immediately after breeding had taken place are given below :

The embryonic and larval development were followed by us and found to agree with the observations of Khan. The larvæ were noticed to commence feeding on the fourth day on the following organisms :

Desmidiaceæ : Closterium, Cosmarium :
Diatomaceæ : Cocconeis, Cymbella, Gomphonema, Melosira, Navicula, Nitzschia, Synedra :
Algæ : Ankistrodesmus, Aphanocapsa;
Protozoa : Chilomonas, Euglena, Eudorina and *Phacus.*

Adult characters were fully assumed when 25 mm. in size and one month old in all the three places. Colour varied from red, yellow, olive brown to black.

It is thus found that the gold fish could be propagated in simple garden pools and aquaria under varying meteorological conditions. This is encouraging from the point of view of the present movement to establish in popular favour for keeping and breeding fancy fishes. The gold fish is however predaceous, and has been observed to feed on young ones of *Etroplus suratensis, Barbus stigma* and *B. ticto* and on its own young ones below one inch in size. Gold fish culture in ferneries and ornamental ponds is also an effective check on mosquito breeding. Atkins[5] and Schrenkeisen[6] have found the species to be effective larvivores. We have observed the fish to consume about 200 mosquitoe larvæ in 24 hours. The fish can be transported over long distances without any casualty provided the water in the container is changed every six hours and the temperature is kept below 30° C.

P. I. CHACKO.
S. V. GANAPATI.

Freshwater Biological Sta.,
Kilpauk, Madras,
April 1949.

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ON THE OCCURRENCE OF ENTEROPNEUSTS IN SHINGLE ISLAND, GULF OF MANAAR[1]

THE occurrence of Balanoglossids in Krusadai Island has already been reported.[2] The area where they are available in moderately large quantities has been termed as the 'Balanoglossus area'[3].

On the 7th, 8th and 22nd of October 1948, fifty specimens of Balanoglossids were collected from Shingle Island which lies cut away from Krusadai by a gap of over a mile and a half width. The specimens were collected from the southern shores of the Island in a small lagoon enclosed by dead coral reef. The animals were found comparatively deeper down the sand than at Krusadai.

Though systematic collections of marine animals have been made in Krusadai and nearby islands by various biologists year after year no record has so far been traced to indicate the presence of this protochordate in Shingle Island. A search for these animals in islands nearby would throw more light on the distribution and ecology of this primitive chordate.

Krusadai Island, G. K. KURIYAN.
Gulf of Manaar,
February 1949.

1. Published with the kind permission of the Director of Industries & Commerce, Madras.
2. Narayna Rao, C. R., *Curr. Sci.*, 1934, **3**, 70.
3. Ramanujam, S. G. M., *Ibid.*, 1935-9, 427.

SEQUEL TO THE HYBRIDIZATION BETWEEN THE SUGARCANE × THE BAMBOO

PROFESSOR C. A. TAYLOR of State College of Agriculture, Brookings, South Dakota, U.S.A., considers that the systematic positions of the bamboo, sugarcane and the panicoid grasses might need revision in the light of successful hybridization between the sugarcane and the bamboo. He thinks that the floral morphology and anatomy of the genera *Arundo* and *Ochlandra* might throw some light on the problem and wishes to get into touch with researchers in India who have worked on the two genera.

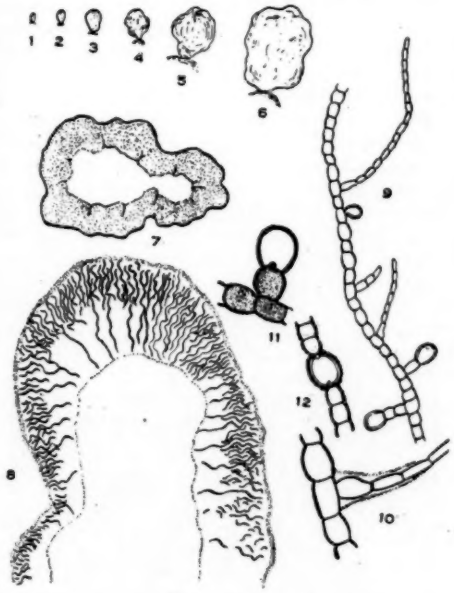
T. Nagar, T. S. VENKATRAMAN.
Madras,
June 19, 1949.

ON A *NOSTOCHOPSIS* FROM MYSORE

LARGE collections of a species of *Nostochopsis* agreeing closely with *N. lobatus* (Wood)

Geitler were made recently in the Cauvery River which enabled a study in some detail. The alga occurs in abundance during the months from November to January, attached (Figs. 1-6) to the large boulders submerged in water and sheltered from exposure to direct currents. As the alga grows in size its attachment to the rocks becomes less firm, and finally gets detached. Consequently numerous individuals are found floating in the currents and this seems to be one of the important modes of dispersal.

The young thalli appear like small qluish-green pinheads on the submerged surfaces of the rocks. Earlier stages than these also occur on the rocks as flat slimy encrustations.



FIGS. 1—12

Figs. 1-6. Showing the development stages of the thallus. Natural size. Fig. 7. Section through young thallus to show the hollow nature × 2. Fig. 8. Enlarged view of part of the same × 24. Fig. 9. Portion of the trichomes at the branching zone × 970. Fig. 10. Showing the development of the lateral branch × 970. Fig. 11. Lateral heterocyst × 970. Fig. 12. Intercalary heterocyst × 970.

As development proceeds, the young baloon-shaped gelatinous thallus assumes a subspherical to globoid shape, and shows numerous convolutions. In the mature condition the thallus measures upto 20 cm. in diameter (reported to be 3·5 μ by oversight by Desikachary[1]), and is cinnamon-yellow to yellowish-brown in colour. In many cases, small green islands of actively growing groups of filaments are seen on the mature thallus.

Microtome sections of the young thalli revealed that in early stages the filaments are compactly arranged without any space in the centre. However, in a relatively mature condition a large hollow space is formed in the centre (Figs. 7 & 8) as is characteristic of *Nostochopsis lobatus* decribed in detail by Geitler[2] and by Desikachary.[1] Some of the stages in the formation of the hollow space have been followed. In brief it may be stated, that the hollow space in the centre is formed as a result of moving apart, or lax arrangement of the filaments which get grouped compactly towards the periphery (Fig. 8).

Morphological study of the material collected by the writers revealed that the plant body is composed of a tangle of filaments embedded in an amorphous gelatinous matrix. A fairly large thallus is differentiated into a basal attachment region where the filaments are small contorted and without much cell contents, a middle region which is hollow or rarely traversed by groups of lax filaments, and an outermost region where the long filaments are densely grouped and have tapering ends.

Within the thallus the trichomes are radially arranged. Each trichome can be roughly differentiated into a basal region, a middle region showing branched condition and the cells manifesting beaded appearence (Figs. 9 & 10), and a projecting portion. The cells of the basal and middle regions are barrel-shaped while those of the projecting portion are cylindric to rectangular.

The heterocysts are either lateral [in which case (Figs. 9 & 11) they are either sessile or borne on one to four basal stalk cells] or intercalary (Fig. 12). The lateral heterocysts are ovate-ellipsoid to spherical, and measure 5·0—9·2 × ·5—9 ·0μ.

Grateful thanks are due to Dr. L. N. Rao, for helpful suggestions and encouragement and to Dr. M. J. Thirumalachar for help in making field observations.

H. C. GOVINDU.
Bangalore, B. A. RAZI.
April 16, 1949. K. M. SAFEEULLA.

1. Desikachary, T. V., *J. Indian Bot. Soc. M. O. P. Comm.* Vol. 1946, 225-38. 2. Geitler, L., "Cyanophyceæ" in Pascher's *Susswasser-flora* 1925, **12**, 174-76, Jena.

OCCURRENCE OF HYALINE TRABAECULAR CELLS IN THE MESOPHYLL OF *DERRIS BENTHAMII*

IN the course of the studies on the foliar sclereids of flowering plants the writers noticed the presence of conspicuous trabæcular cells in the leaf sections of *Derris Benthamii* Thw., which warranted a more detailed investigation. In sections of young leaves there is a single layer of palisade cells contiguous with a layer of collecting cells. Beneath this, a single layer of hyaline rounded cells forms a distinct stratum thus connecting the spongy cells below and the collecting cells at the top.

Observations indicate that as the leaves mature, the hyaline cells elongate considerably transforming themselves into long trabæcular cells (Fig. 1). These broaden out

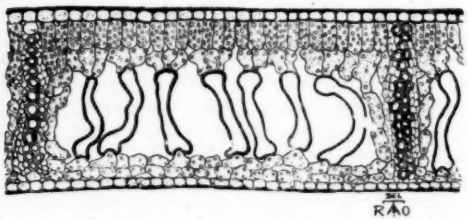


FIG. 1. Trans. section of the leaf showing the disposition of the trabæcular cells. × 150.

at either ends and connect the collecting cells with spongy cells. Large air spaces are differentiated in the mesophyll as small pockets bordered and supported by the trabæcular cells. In early stages, the trabæcular cells possess dense cytoplasmic contents, and considering their articulation with the collecting cells, they appear to take part in the translocation of solutes and plastic materials within the leaf. In the mature leaves however, these cells appear vacuolate and their cell walls become conspicuously thickened with cellulose material. Many of them turn brown due to accumulation of tannin material within their lumen.

Similar, though not so conspicuous, hyaline cells usually termed as 'middle layers' have been recorded in some members of Leguminosæ including species of *Derris, Lonchocarpus, Pongamia* and others.[1] These cells are also reported to turn brown in later stages due to the accumulation of tannin material but they are never known to elongate into long trabæcular cells as seen in *Derris* species under study.

We wish to thank Dr. M. J. Thirumalachar for guidance and help.

M. R. Science Institute, T. ANANDA RAO.
Gujarat College,
Ahmedabad.
&
Agricultural College, H. C. GOVINDU.
Hebbal, Bangalore,
May 30, 1949.

1. Solereder, H., *Systematic Anatomy of the Dicotyledons*, **1**, p. 258, Oxford, 1908.

SCHIZANTHUS SP. A HOST OF TOBACOO LEAF-CURL VIRUS

DURING January 1949 over 50 per cent. plants of *Schizanthus* sp. in a particular area of the Institute were found to be diseased. The infected plants were stunted and their height was below 12″ whereas the normal healthy plants were over 24″ in height. The leaves of affected plants were much reduced in size and bronze in colour. In general, the affected plants offered a crowded appearance. The leaves exhibited downward curling and rolling of the margins of leaflets inwards. The severely affected plants failed to produce any flowers, but the less severely affected plants bore comparatively few flowers which failed to set seed. Fig. 1 shows an infected plant of *Schizanthus*.

FIG. 1

All attempts to transmit the disease by inoculation with the extract of infected *Schizanthus* leaves in the presence of carborundum powder to *Nicotiana tabacum* L., varieties Harrison's Special and White Burley, *Nicotiana glutinosa* L., *Lycopersicum esculentum* Mill., variety Sutton's Early Market, *Datura stramonium* L.,

Solanum nigrum L., *Solanum nodiflorum* Jacq., and *Capsicum annuum* L., were unsuccessful.

The disease was, however, successfully transmitted by grafting to *Nicotiana tabacum* L., variety Harrison's Special, *Datura stramonium* L. and *Lycopersicum esculentum* Mill., variety Sutton's Early Market.

On *Nicotiana tabacum* var. Harrison's Special, downward curling of young leaves was observed about five weeks after grafting. This was accompanied by puckering and chlorotic areas on lower leaves. The veins on the underside of the leaves showed greening and thickening at certain places which was followed by the development of numerous small sessile, cup-shaped enations. The leaves were much reduced in size and the plant on the whole was appreciably dwarfed. Fig. 2 shows *Schizanthus* grafted to tobacco plant.

FIG. 2

Datura stramonium exhibited marked downward curling, reduction in size and mottling and wrinkling of the leaves. The symptom picture on *Lycopersicum esculentum* was almost identical with that of *Datura stramonium*.

White flies (*Bemisia tabaci* Gen.) fed in microcages on diseased *Schizanthus* plants for 24 hours when transferred to young plants of *Nicotiana tabacum*, variety Harrison's Special in the insect-proof house successfully produced typical symptoms of the leaf-curl disease.

The importance of *Schizanthus* sp. as a host of the virus lies in the fact that it may serve as a source of infection to other economic crops.

Thanks are due to Dr. R. S. Vasudeva, Head of the Division of Mycology and Plant Pathology, for his guidance.

Division of Mycology and Plant Pathology,
Indian Agri. Research Inst.,
New Delhi,
June 18, 1949.

R. P. GARGA.

A NEW METHOD FOR THE DIAZOTISATION OF AMINES

IN connection with our work on the preparation of a few azodyestuffs from 13-amino benzanthrone, a rapid and easy method for the preparation of the diazonium salt was required. The 13-amino benzanthrone is insoluble in acids under the usual conditions and hence the diazotisation presents a special problem. A. Luttringhans and H. Neresheimer (*Ann.*, 1929, **437**, 259-89) have carried out the diazotisation of the above amine using nitrosyl sulphuric acid. The method however is not rapid and easy. We have developed a new method for diazotisation of the amine. The method can be outlined as follows:—

The amine (1 mole) is dissolved in concentrated nitric acid (3 moles). The mixture is externally cooled by ice and salt and is then treated with the calculated amount of sodium bisulphite or sodium hydrosulphite (hydros) dissolved in a small quantity of water. The temperature is not allowed to rise above 0-5° C. At higher temperatures, the reaction proceeds extremely vigorously. The reaction is complete within 3-5 minutes.

The method has been extended to other aromatic amines belonging to the benzene and naphthalene series. In all the cases studied, rapid and successful diazotisation was observed. Further work in this connection, is in progress and a detailed paper on the same, will be published shortly.

St. Xavier's College,
Bombay No. 1,
May 25, 1949.

A. DIAS.
A. N. KOTHARE.
V. V. NADKARNY.

REVIEWS

The Freezing of Super-Cooled Water. By N. Ernest Dorsey. *Transactions of the American Philosophical Society*, New Series. Vol. 38, Part 3, November 1948. Pp. 247-328. Price $ 1·75.

In this memoir which extends well over 180 pages, Dr. Dorsey of the United States National Bureau of Standards, author of the "Propertie of Water-Substance" reports the results of his investigations of the supercooling and freezing of water. These studies though carried out intermittently, extended over a period of twelve years. The report does not contain any startling results; but it is a record of the basic facts concerning the subject.

The primary purpose of the investigations according to the author was to determine how variable might be the temperature to which a given specimen hermetically sealed in a glass bulb can be supercooled, and whether and to what extents the supercooling is affected by (1) agitation, (2) thermal shock and (3) length of time that the specimen had been supercooled. The results obtained have been compared with those which have been widely believed to be demanded by the kinetic theory of freezing called the "homogeneous theory" and the author has come to the conclusion that the above theory is entirely inapplicable within the range of supercooling covered by this work. A new and explicit heterogeneous theory of freezing, which accounts qualitatively for the observed phenomena has been outlined and discussed. A bibliography containing 166 references to original papers has been included.

R. S. K.

Svalöf (1886-1946). History and Present Problems. Edited A. Akerman, Ph.D., *et al.* Lund, 1948. Pp. 389. Price £ 1-10-0 or 20 Swedish Kronen.

The Swedish Seed Association celebarated its sixtieth anniversary in 1946. In connection with this anniversary it has produced this volume bearing the name of the Swedish village Svalöf, which is now known to all the plant breeders, owing the plant breeding station located there and administered by the above association.

This volume is symposium by the different specialists concerned with agricultural improvement in Sweden and directly connected with Svalöf station. The different papers deal with the organisation and history of the station, as well as the practical and theoretical aspects of plant improvement for Swedish agriculture. The editors are Doctors A. Akerman, O. Tedin and K. Fröier and the English technical editor is Dr. R. O. Whyte of Aberystwyth. In the twenty-two papers, a clear picture of the activities of the research station is presented, and owing to the high quality of the work, is a welcome contribution to knowledge of plant breeding.

The name Svalöf is to many, connected with a method of selecting from hybrid progenies. As can be expected from the record of the station the chapters dealing with hybridisation and selection, generally, or in specific crops, is critical and informative, and is likely to be of use to plant breeders in India. In use of X-ray in induction of useful mutations, the Savalöf station has made considerable effort and the relevant chapter is of interest. Dr. Levan deals with the cytogenetic aspect of breeding, and discusses the production and utilisation of polyploid crop plants. In this new branch, very few successes can yet be recorded, but Svalöf is testing and developing a promising line of work, the amphidiploid wheat—rye hybrid and this is discussed by Dr. Arne Muntzing.

The avowed function of the book, 'to indicate the willingness of Swedish Plant Breeding to take part again in the international collaboration of scientific plant breders' is well fulfilled. The typography and illustrations is of the high standard familiar to readers of '*Hereditas*'. The occasional awkwardness in English idiom and usage is scarcely noticeable by the reader interested in its technical content.

C. G.

Growth Substances and Their Practical Importance in Horticulture. By H. L. Pearse. (Aberystwyth): *Commonwealth Bureau of Horticulture and Plantation Crops. Tech. Com.*, No. 20), 1948. Pp. 233. Price 12 *sh.* 6 *d.*

The Commonwealth Bureau of Horticulture and Plantation Crops has brought out previously two communications on plant hormones with regard to their practical importance in horticulture. These communications are (1) Plant Hormones and Their Practical Importance in Horticulture (*Tech. Com.* No. 12) by H. L. Pearse, who is also the author of the communi-

cation under review and (2) Fruit Fall and Its Control by Synthetic Growth Substances (*Tech. Com.* No. 18) by M. C. Vyvyan. In *Technical Communication* No. 20 Pearse has not only incorporated the information included in *Technical Com.* Nos. 12 and 18 but has also added considerably by referring to more recent information available on the subjects.

The summarising of the vast literature available on growth substances has been done under different headings in respect of their uses. The first section deals with use of growth substances in vegetative propagation followed by others on treatment of seeds and seedlings, treatment of growing plants and induction of parthenocarpic development of fruit. The last but one section which deals with selective hormonal weedicides is although or practical importance in horticulture has a far wider application in general agronomic practices since control of weeds in crops is of greater importance. The last two sections deal with the inhibition of dub development and other practical uses of growth substances respectively.

Since hormones are responsible not only in promoting growth but also in its inhibition it is not surprising to find the number of different horticultural practices to which growth substances can be put to use. The varied uses of growth substances are very clearly summarised and horticulturists will find the information given of considerable help.

Practical hints of importance given are those relating to the substances to be used for the different purposes, their dose, duration of treatment and method of application. The effect of growth substances on histological development and the physiology of treated plants are also dealt with.

185 pages or nearly three-fourths of the communication is devoted to an index of typical results obtained by the use of growth substances on cuttings of over 880 plant species including varieties and hybrids. This information would be of considerable importance to workers who desire to investigate further the effect of growth substances on other untried species.

The exhaustive work done by Pearse can easily be gauged by the extended bibliography furnished at the end which includes over 1465 references. Even at that the author modestly states that reference has been made to as many works as possible and that possibly there may be some omissions. Of the references furnished it is observed that more than 1275 fall within the period of 1927 to 1948 which indicates that a greater amount of work on growth substances has been carried out during the past two decades.

Horticultural workers the world over should be indebted to Pearse for summarising the extensive literature on growth substances in a manner that would be useful to laymen as well as advanced workers in the field and they should also be thankful to the Commonwealth Bureau of Horticluture and Plantation Crops for bringing out the communication which will be of inestimable value to further work.

L. S. S. KUMAR.

Five Figure Tables of Mathematical Functions. By J. B. Dale. (Edward Arnold & Co., London), Second Edition, 1949. Price 6 *sh.* net.

This book of tables whose first edition appeared in 1903, and which was reprinted several times now appears with some slight changes. The book is intended for advanced workers in Applied Mathematics and Statistics. It contains, besides the usual logarithmic and trigonometric tables, tables of the Bessel Functions $J_0(x)$, $J_1(x)$, $J_n(x)$, $I_n(x)$, Tables of the Probability Integral Erf (x), Tables of the Elliptic functions

$$\mathrm{E}(K, \phi) = \int_0^{\phi} (1 - k^2 \sin^2 x)^{\frac{1}{2}}\, dx$$

$$\mathrm{F}(K, \phi) = \int_0^{\phi} (1 - k^2 \sin^2 x)^{-\frac{1}{2}}\, dx,$$

where $\sin \theta = \mathrm{K}$, and some other tables.

The book is not a compendious treatise like the famous Jahnke-Emde tables, but is a handy book of 121 pages, and should on that account prove popular for the type of students for whom it is intended.

C.N.S.

Anatomy of Semnopithecus entellus. By A. Ananthanarayana Iyer (Indian Publishing House), 1948. Pp. 182.

This book is the outcome, according to the author, of the numerous requests of the fellow-workers to have in print an anatomical account of *Semnopithecus* which was submitted by the author as a thesis for the M.Sc. degree of Madras University in 1942.

While fragmentary anatomical accounts of the sacred Indian Langur were available, no connected account of all the systems could be had and the book before us, aims at giving an account of all the systems of the Old World monkey and also examines the interrelationships of the Primates.

After discussing the systematics of the group (Chapter II), externals are described in

Chapter III, flexor lines and papillary ridges (dermatoglyphics) in Chapter IV and the skeleton in Chapter V. *Semnopithecus* shows the lacrimo-ethmoidal apposition and it would have been very useful if the causes and modifications responsible for the erect-sitting of the Langur were narrated. We are not impressed with the figures 2, 3, 13 and 14; better photographs could have been reproduced.

The Langur lacks an inguinal ligament (Chapter VII) and the system is described in great detail (Chapter VIII). With regard to the facial musculature, the author argues that the musculature is generalised and the buccal herniæ have in no way altered it.

The author has definitely been able to to confirm that the stomach is not of the ruminant type though spuriously resembling it. Barring Lemuroidea, the *entellus* stomach is tripartite like that of the Primates and each part is subservient to its mode of diet.

While describing the ductless glands, independent ones (Chapter XVI) which function as endocrine glands are described omitting discreetly the pancreas. The heart and the principal vessels are dealt with in Chapter XVII. For a student of human anatomy, the blood vascular system of *Semnopithecus* is not very different except for the too frequent variations met with in the venous system. In the chapters of the nervous system the labellings of the fissures, etc., is impossible to read. *Semnopithecus* brain occupies a very high position among that of the Cercopithecid series and it is hoped that the author will be able to give an account of its minute structure.

Chapter XXI is devoted to recounting a set of twenty significant features of *Semnopithecus*. An exhaustive bibliography and index follow.

A number of minor errors have crept in; *Semnopithecus* (pp. 129, 106) and *Macacus* (p. 108) commence with a small letter; cutaneous is wrongly syllabified (p. 45, fig. 27); xithoid for xiphoid (p. 85, fig. 61); Palæntology for Palæontology (p. 174); photo 76 does not show what it is intended to. No uniformity is observed in citing years of references (pp. 47 and 48); the use of definite article before generic names (pp. 104, 110, 112) and structures named after discoverers [Spigelian lobe (p. 104), Sylvian fissure (p. 140)] is undesirable. The term 'Entellus' (pp. 140, 145) should have been in italics. Finally reference to Sutton is not given in the bibliography.

The book is a valuable addition to our knowledge of the Old World monkey serving as a companion volume to "The Anatomy of the Rhesus Monkey". A study like this will not only enable us to gain a better comparative account and knowledge of the higher Primates but also help us to place systematically the group on a firmer basis.

L. S. R.

Report of Proceedings of the Specialist Conference on Geology and Mineral Resources, London, September 1948 (His Majesty's Stationery Office), 1949. Pp. 1-18; Price 6d. net.

The British Common Wealth Scientific Official Conference held in 1946, had suggested that certain of the subjects may be discussed in Specialist Conferences called at suitable intervals availing of the opportunities provided by the presence of delegates from the Commonwealth Countries at International Congresses or Meetings. Accordingly, just after the close of the International Geological Congress which was held in London from August 5th to September 18th, 1948, a meeting of the geologists representing United Kingdom, South Africa, Southern Rhodesia, Canada, India, Australia, New Zealand, and the Colonies, was convened. It was not a gathering for discussion of Scientific Papers on Geology and Mineral Resources, but was expressly invited for drawing up concrete proposals for Commonwealth collaboration. In drawing up the proposals, the members were not bound by any of the suggestions or directives made by the 1946 official Conference, and Sir Edward Appleton in his opening remarks to this Conference advised the members themselves to decide first what the objectives were and then to formulate the kind of machinery required to attain them.

The Conference met for 3 days and discussed many questions—such as the facilities existing and required for a proper survey of the mineral resources and reserves of the Commonwealth, presentation of Mineral Statistics, training of geologists, geophysical prospecting, photogeology, palæobotany, clay minerals, coal research, and publications. A number of recommendations have been made. The constitution of a permanent committee to be known as the Committee on Mineral Sources and Geology with members from each of the participating Commonwealth Countries,—together with some details regarding the executive and secretarial work of this Committee—have been recommended. As regards presentation of Mineral

Statistics, it was decided that the question of formulating the degree of standardisation should be discussed at the Commonwealth Statisticians Conference scheduled to meet in Australia.

The Conference while noting with satisfaction the increased facilities being provided for the assessment of mineral resources by the respective governments, has recommended that salary scales and career opportunities for Geologists throughout the Commonwealth should be comparable, and also that the requisite standard for entrance into the official geological surveys be maintained by prescribing a good honours degree or its equivalent in geology, preferably supplemented by post-graduate research work. Another resolution is to the effect that Governments should further the study of specialised problems in geology, geophysics and mineral investigations by facilitating either exchange of specialist workers or visits of specialists from one country to another. Such personal contacts would be a more effective way of securing mutual co-operation and understanding between the workers in different countries.

Amongst the resolutions relating to publication, two are very important: (i) that a central organisation like the Geophysics Department of the Imperial College of Science in London, might be invited to act as a centre for co-ordinating and disseminating the information contained in reports of geophysical investigations, and (ii) that the Geological Surveys throughout the Commonwealth should take steps to publish an annual volume of abstracts of all geological papers published relating to the territories for which they are responsible.

All the various recommendations of the Conference appear practicable and there is no doubt that the Commonwealth Countries, individually and as a whole, will stand to benefit if early steps are taken to implement the substance of these resolutions.

M. B. R. Rao.

A Prospector's Handbook to Radioactive Mineral Deposits. *Department of Scientific & Industrial Research, Geological Survey and Museum.* (London: H. M. Stationery Office), 1949. Pp. 1-28. Price 6*d.* net.

Ever since the possibility of utilizing Atomic energy was established, the search for ores containing uranium and thorium has received great impetus. Naturally, there is much eagerness on the part of Geologists, Prospectors, and persons connected with the promotion of mineral industries, for procuring useful practical information on the mode of occurrence, methods of identification, processes of concentration, and commercial intelligence concerning the radioactive ores. This Handbook supplies such information, and is a welcome addition to the growing literature on the subject.

After furnishing a description of the economically important minerals which number about a dozen, a concise but quite comprehensive account is given of the geological conditions in which the radioactive mineral deposits have been found in different parts of the world. On the basis of the knowledge and experience gained, valuable hints are given for exploration in virgin territory as to the nature of the rock-formations and geological associations which are likely to be favourable for the location of radioactive minerals.

Supergene deposits, polymetalliclode deposits, pegmatites, carnotite deposits in sedimentary rocks, placer deposits, and other notable occurrences which are important sources for these ores, have been described.

The possibility of obtaining radioactive ores as by-products from certain of the existing mines in the tailings and other discarded products from the quarry dumps, has been pointed out. Instruments and methods of detecting the presence of radioactive minerals have been explained. The use of portable Geiger Muller counters, fluorescence lamps, photograhic techniques and some special chemical tests have been described with up-to-date information, in sufficient details to serve the practical needs of the geologist and the prospector. It would have been better if a list of the instruments which have now come into the market under various trade names such as "Radioactivity Detector," "Mineralight," etc., also had been furnished in an appendix stating the addresses of the manufacturers and suppliers. However, those specially interested in purchasing the instruments and intending to do active exploration, would do well to consult any of the official Geological Surveys engaged in work on radioactive minerals.

The market for radioactive minerals usable for nuclear fission may be said to be almost unlimited. No other ores or mineral products command at the present time such an enviable position in the commercial world. To promote exploration for such minerals throughout its colonial territories, the British Ministry of

Supply have announced the minimum guaranteed prices for uranium ores of stipulated grade—an offer to hold good for the next ten years. The terms and conditions of purchase are set forth in the last chapter.

Dr. C. F. Davidson, Chief Geologist, Geological Survey of Great Britain, who has so ably written this Hand Book, has brought together in a very short volume much useful and up-to-date information on the subject.

M. B. R. RAO.

"A Dictionary of Metallography". By R. T. Rolfe. (M/s. Chapman & Hall Ltd., London). 1949. Pp. xii+287. Price 18 *sh.* net.

This book is the first of its kind to offer the reader such comprehensive data on metallurgical subjects for which normally one has to look up an unlimited number of books and journals—a very tedious task indeed. By presenting the entire data in an admirably concise and scientific manner, the author has filled a sorely felt gap in the library of metallurgical texts.

The book will undoubtedly capture the interests of the students, research workers and of professional metallurgists and engineers the world over.

The author deserves warm congratulations for his service to the community of Metallurgists.

B. R. NIJHAWAN.

SCIENCE NOTES AND NEWS

High Altitude Research Station

On the recommendation of the Council, a party of three scientists visited Sikkim and Jumontri on the Himalayas for selection of a suitable site for the establishment of a High Altitude Research Station. The Committee will soon visit the Baralacha area, after which final selection of the site will be made.

An expert Sub-Committee, consisting of eminent scientists, is drawing up a detailed plan for the Research Station, which will be fully equipped to handle snow survey and glaciology, meteorology, astronomy and cosmic ray research and investigations on mineral resources and the flora and fauna of the Himalayan regions. The Research Station will function under the joint auspices of the Council, the Central Waterpower, Irrigation and Navigation Commission and the Indian Meteorological Department.

Council of Scientific and Industrial Research

New Schemes of Research

On the recommendations of the Board of Scientific and Industrial Research, the Governing Body of the Council has sanctioned the following new schemes of research at a cost of Rs. 1,50,000.

1. Synthesis of Citrinin and preparation of derivatives of Citrinin—Dr. K. Venkataraman, Bombay.
2. Elucidation of the constitution of essential oils and their synthesis—Dr. P. C. Guha, Bangalore.
3. Physico-chemical properties of hides, tanned and untanned—Dr. B. N. Ghosh, Calcutta.
4. Scheme of research on leather—Mr. B. M. Das, Calcutta.
5. Studies on colloidal instability of cloud particles above and below the freezing temperature—Dr S. K. Banerjee & Dr. L. S. Mathur, New Delhi.
6. Polarisation of downcoming radio waves—Dr. S. R. Khastgir, Benares.
7. Cellulose decomposition by soil fungi with special reference to its application in fermentation technology—Dr. T. S. Sadasivan, Madras.
8. Enzyme bates—Mr. S. N. Sen, Calcutta.
9. Research on soft X-rays—Prof. S. N. Bose, Calcutta.
10. Development of magnetic dust cores—Mr. B. D. Toshnilal, Bombay.
11. Development of an electronic type of frequency analyser—Dr. N.B. Bhatt, Bangalore.
12. Study of intensity variation of shortwave radio signals and their bearing on the Ionosphere—Dr. S. S. Banerjee, Benares.
13. Studies of correlation between abnormal variation of region Fionisation of the ionosphere and similar variation of the Night Sky Emission—Dr. S. N. Ghosh, Calcutta.

Housing of the Scientific and Technical Societies in Calcutta

A proposal has been sponsored for the housing of the offices of the scientific and technical societies in a central locality in

Calcutta. The proposal envisages the provision of an attached well-equipped scientific and technical library, a science museum, an appropriate number of lecture and meeting rooms and also temporary residential accommodation to visiting members and other eminent scientists and specialists from different parts of India and overseas. Under such a scheme, the disabilities which many of the institutions now suffer from would be largely removed, and better scope would be available for the informal discussion and solution of many problems which have arisen and will arise in the scientific and technical fields. It will also be possible to bring about frequent joint discussions of specialists representing the different sciences to effect a better appreciation of each others' views and scope of work, and the widening of the horizon of scientific knowledge, by removing the barriers which tend to confine the specialists to working in water-tight compartments.

The representatives of the scientific societies and learned bodies who met to consider the proposal have been unanimous in their support and a committee has been formed to suggest ways and means of implementing the proposal.

Among the institutions whose support has already been obtained are—

Indian Science Congress Association; Indian Institute of Chemical Engineers; Indian Institute of Metals; Zoological Society of Bengal; Geological, Mining and Metallurgical Society of India; Botanical Society of Bengal; The Mining, Geological and Metallurgical Institute of India; Bangya Vignyan Parisad; Science Club; and Physiological Society of India.

In addition the following societies are also giving consideration to the matter—

Royal Asiatic Society of Bengal; Indian Chemical Society.

The National Institute of Sciences of India has nominated a representative to take part in the joint deliberations of the societies.

Research-Club

Addressing the members of the Research-Club, H.B.T.I., Kanpur, Mr. M. G. Gupta traced the history and theory of anodisation and colouring of aluminium and said that the problem of protection of aluminium and its light auoys from atmospheric and chemical corrosion is of great commercial importance specially in Naval and aircraft industries. Anodisation has not only fulfilled the commercial demand but also developed an æsthetic aspect of the use of metal. It has now revolutionised the metallurgical conception of the modern age.

Continuing Mr. Gupta said that the anodisation was an electrolytic process similar to the electroplating and by electrolysis of acidulated water develops on the metal a thin film of Al_2O_3, which besides being on auto-corrosive acts as a mordant for acid organic dyes, paints, varnishes, etc. Discovery and commercial exploitation of this process has opened a new chapter in the fabrication of the metal. To-day aluminium articles can be made in every shape, shade and colour.

Mr. Gupta opined that the industry was a very paying one and with a capital investment of about Rs. 75,000 a net profit of about 35% can be expected. At present there is only one factory in U.P. and about half a dozen factories in the rest of India working out this process. To-day India needed many more such factories.

Concluding the speaker said that only recently anodised aluminium sheets have been used for making photo-prints and for producing beautiful multi-coloured articles and name-plates.

Coconut Research Scheme, Ceylon

Dr. Reginald Child has relinquished the post of Director of the Coconut Research Scheme, Ceylon, which he has held since 1932. He will be succeeded by Mr. F. C. Cooke, B.Sc., A.M.I. Chem.E., who was Chemist (Coconut Products) with the Department of Agriculture, Malaya, from 1929-1938, and Canning Officer of the same Department from 1946 to 1949.

Central Committee on Soil Science

The Government of India have decided to appoint a Central Committee on Soil Science with a view to guide and co-ordinate the scientific study of soil in the country which is essential to put agricultural production on a planned basis. Composition of soil, its depth, its nutritional properties, mineral and moisture contents, etc., play a large part in intensive cultivation schemes which aim at producing the maximum out of the soil without impairing its fertility in any way.

The functions of the Committee will be:

to advise the Government of India on matters of soil research and soil surveys;

to guide and co-ordinate the scientific study of soil so as to ensure that soil survey proceed on right lines;

to lay down the lines of soil survey to be followed for purely scientific and specific utilitarian purposes, and soil survey training;

to preserve in a central place the soil profiles representative of various types of soil;

to provide for the interchange of information and samples regarding soil types amongst the workers within the country as well as in foreign countries.

The Committee will be composed of:

1. Dr. J. N. Mukherjee, Director, Indian Agricultural Research Institute (*Chairman*).
2. Dr. Dalip Singh, Principal, Government Agricultural College, Amritsar.
3. Dr. J. K. Basu, Soil Physicist, Government of Bombay.
4. Mr. P. D. Karunakar, Agricultural Chemist, Government of Madras.
5. Dr. R. C. Hoon, Officer on Special Duty, Central Waterpower, Irrigation & Navigation Commission.
6. Dr. B. K. Mukherjee, Director, Sugarcane Research Station, Shahjehanpur, U. P.
7. Dr. A. T. Sen, Soil Conservation Officer, Ministry of Agriculture, and
8. Soil Survey Officer of the Indian Agricultural Research Institute (*Technical Secretary*).

The Committee will function under the Central Ministry of Agriculture. Soil profiles from various Provinces and States will be preserved at the Indian Agricultural Research Institute, New Pusa, and the work on the preparation of soil maps of India, according to the lines laid down by the Committee, will be entrusted to the Institute.

British Association for the Advancement of Science

The next annual meeting of the British Association is expected to be held in New Castle-upon-Tyne from August 31st to September 7th 1949. Sir John Russell, F.R.S., the President of the Session, will deliver the Presidential Address on "World Food and World Population". Among the evening discourses scheduled to be delivered during the session is the one to be given by Dr. Hans Petterson, Leader of the Swedish Deep-Sea Expedition, on Exploration of the Ocean Floor.

A full programme giving detailed arrangements will be published about August 10 and will be sent to all who intimate their intention to attend the meeting.

Institute of Jute Technology

An Institute of Jute Technology is in the process of being jointly sponsored by the University of Calcutta and the Indian Jute Mills Association. The Institute, which is estimated to cost Rs. 20 lakhs on capital expenditure and Rs. 2 lakhs recurring annually, will conduct research and train personnel for the industry.

Research in Yoga

The Government of India have sanctioned a grant of Rs. 20,000 to Kaivalya Dhama, an Institute for training in *Yoga*, to conduct research on the scientific aspects of Yoga. The Institute has been functioning at Lonavla, near Bombay, for the last 24 years. According to Swami Kuvalayananda, Founder Director of the Institute, the aim is to "develop a philosophy and a culture through the coordination of yogic experiences and modern sciences that would lead to a proper understanding of man as a whole and thus avoid any future conflicts between man and man".

World Forestry Conference

President C. R. Ranganathan of the Forest Research Institute, Dehra Dun, will represent India at the World Forestry Conference which is scheduled to meet at Helsinki during the middle of July (10th to 20th July). The conclusions reached at the Regional Conference held recently at Mysore will come up for discussion. The agenda for the plenary session includes discussion on forest resources and requirements, repurcussion of industrial and chemical development on sylviculture and forest management.

Big Engineering Exhibition in Glasgow

Scotland will play an important part in the Festival of Britain to be held in 1951. One of the main displays connected with the Festival will be staged in Glasgow and will be one of the four major exhibitions to be held outside London.

It will be planned to illustrate the theme of Britain's contributions—past, present and future—to heavy engineering and shipbuilding. It will last about 14 weeks and is expected to attract at least 1,000,000 visitors. No similar exhibition has ever been organised on so large a scale before. It will vividly present the story of a century's progress in all forms of heavy engineering.

Editor: M. Sreenivasaya, B.A., F.I.I.Sc., F.A.Sc.
970-49 Printed at The Bangalore Press, Bangalore City, by G. Srinivasa Rao, Superintendent and Published by Dr. M. A. Govinda Rau, M.A., Ph.D., for the Current Science Association, Bangalore.